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V.—ON THE DISTRIBUTION OF PELAGIC INVERTEBRATE FAUNA OF THE FIRTH OF FORTH AND ITS VICINITY

during the Seven Years from 1889 to 1895, both inclusive. By THOMAS SCOTT, F.L.S., Mem. Soc. Zool. de France. (Plates IV., V., VI., VII.)

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INTRODUCTORY.

The scientific investigations that have until recently been carried on in the Firth of Forth, and also outside the limits of the estuary, included among other things the examination of the various groups of pelagic invertebrates that form so important a part of the food of fishes. The examination was carried on chiefly in connection with the trawling operations of the *Garland*, the steam cruiser set apart specially for scientific work. The trawling experiments of the *Garland* were made over certain fixed portions of the estuary and neighbourhood which were denominated "stations." The method adopted for the examination of the pelagic invertebrates was somewhat as follows:—During the time that each station was being trawled two tow-nets were kept constantly at work. One of these was towed at about half a fathom below the surface of the water, and was distinguished as the surface tow-net; the other was fastened to the end of the beam of the trawl in such a way as just to clear the bottom, and was distinguished as the bottom tow-net. Sometimes other nets were used at intermediate depths, but not with the same regularity as the first two. The gatherings collected with these mid-water nets are therefore not specially referred to in this paper. The tow-nets at first in use were comparatively of small size, but subsequently a larger kind, somewhat similar to those that had been used on board the *Challenger*, were adopted, and are still used in connection with the Board's scientific work.

At first nine experimental stations were selected for the carrying out of special scientific work, but this number was afterwards increased to ten. It has not, however, been considered necessary for the purposes of this paper to take note of the published statistics for all these stations, and therefore six of them have been fixed upon as representative of the others—namely, Stations I., III., IV., V., VIII., and IX. Stations I. and III. extend from the east side of Inchkeith eastward, and are comparatively near to each other. Station IV. is an inshore station, and extends for a considerable distance round the "South Bay." Station V. extends from May Island westward along the centre of the Firth till nearly abreast of Elie. Stations VIII. and IX. are beyond May Island, and outside the limits of the estuary.

The results obtained by the use of the tow-nets were at first recorded in a somewhat general form, but as the work proceeded the differentiation of the various organisms became less difficult, and made it possible for a more detailed description of the results being placed on record. It will be obvious, therefore, that in the study of the distribution of the pelagic invertebrates the earlier records will not be so useful as those of subsequent date. Moreover, the investigations were not carried on during the first year or two so continuously as they were afterwards, and for these reasons I propose to limit the consideration of the pelagic invertebrates to those collected (by means of the surface and bottom tow-nets already described) during the seven years from 1889 to 1895 inclusive, and recorded in the several Annual Reports for these years.

But though the examination of the pelagic invertebrates within the area under consideration was carried on more or less continuously and regularly during the years referred to, there are times when, for various reasons, no tow-net gatherings were collected, and for which there are no records, so that the records for some years are less complete than for others. In 1889, for example, there are no records of tow-net gatherings for any of the stations in March, April, and December; in 1890, in January and June; in 1892, in August; in 1894, in March, May, July, September, and October; and in 1895, in March, June, and November. Moreover, there may be records for a particular month for some of these stations and not for others. Thus in 1889 though there are records for October for Station I. there are none for any of the other stations; but while that is so there are still a large number of statistics available for at least a partial study of the distribution of the pelagic invertebrates of the Firth of Forth.

The time available for the preparation of this paper did not permit of the detailed consideration of every species or kind of invertebrate recorded in the lists of tow-net gatherings, so that only those that are of numerical importance, or that are otherwise of importance from a fisheries' point of view, are so dealt with, while an endeavour is also made to invite attention to any interesting point observed in connection with the distribution of the other species. Tables illustrating in time and space the distribution of these pelagic forms are introduced wherever they are considered necessary.

Moreover, four charts are added at the end of the paper for the purpose of supplementing and extending the information given in the Tables concerning the distribution of a few of the more, numerically or otherwise, important species or groups of invertebrates comprised in the tow-net lists. These charts not only show when and where the species was abundant, or scarce, or absent, but they also allow of a comparison being made between the surface and bottom distribution of the species. The importance of this will be evident when it is remembered that though a species may be rare at the surface it may at the same time be common or even abundant at the bottom, as well as *vice versa.*

It may further be stated that in proceeding to consider the distribution of the invertebrates mentioned in the various lists of tow-net gatherings collected at the six selected stations during the seven years, those that are higher in the scale of classification are referred to first, and afterwards those that are lower.

It may also be as well to state that there has been a considerable advance in the knowledge of marine zoology since the *Garland* commenced work in the Firth of Forth twelve years ago,* and one of the results of this advance has been the introduction of many changes in the nomenclature of marine organisms. Owing to these changes several of the names mentioned in the *Garland's* tow-net lists are replaced by those that are now considered to be the rightful designations of the species to which they refer; and one advantage of this alteration will be that the results of the tow-net work of the *Garland* will be brought more into line with present-day knowledge.

INVERTEBRATES CAPTURED BY THE TOW-NETS.

The invertebrates captured by means of the surface and bottom tow-nets during the seven years from 1889 to 1895, at the representative stations already referred to, comprised a large number of forms of different kinds, but many of these were only of rare occurrence. The greater proportion by far of the contents of all the tow-net gatherings consisted of only a few species, which may be summed up as follows :—Schizopoda (*Thysanoessa* chiefly, *Erythrops*) ; Amphipoda (*Hyperia*, *Hyperoche*, and *Parathemisto*) ; Copepoda (*Calanus*, *Temora*, *Acartia*) ; *Sagitta* ; Cœlenterata (*Pleurobrachia*, *Beroë*, and others) ; and young Crustacea (Decapoda, Schizopoda, and Cirrepedia). Before proceeding to discuss the distribution of these six groups, as brought out by an examination of the tow-net records, I propose to refer briefly to several of the more uncommon forms which have been captured from time to time at the selected stations and during the years already specified.

(1.) The Mollusca.

There are very few records of Mollusca which have been captured by the tow-nets, and only two really pelagic forms have occurred. The Mollusca recorded comprise two small *Eolis*, the species of which was not determined. One was obtained in the bottom tow-net at Station V. in 1891, and the other at Station I. in May 1895 ; also *Doris* (?) *repanda*, which was obtained in the bottom net in November 1890 at Station III., and *Doto coronata*, obtained in December 1890 at Station IV., also in the bottom net. A few species of *Cuspidaria cuspidata* are recorded under Station IX., having been brought up in the bottom tow-net at that station in April 1893, but the presence of this species was owing, no doubt, to the net having accidentally dipped into the mud at the bottom. The two pelagic species are the Pteropods *Limacina retroversa* and *Clione borealis*. The first is recorded on two different occasions in 1890, having been obtained in April in the bottom tow-net at Station V., and in May in a surface-net gathering at Station I. It was also obtained in the bottom tow-net at Station III. in July 1891, and in the bottom tow-net at Station IX. in December 1892. The other (*Clione borealis*) was captured in the surface tow-net at Station III. in January 1889, in the bottom tow-net at Station V. in November 1893, and in the surface net at Station VIII. in December of the same year. *Limacina retroversa* is a very generally distributed species, but seems to be more common on the West than it is on the East Coast. On the West Coast it sometimes occurs in immense shoals, and at times forms a considerable part of the food of the herring. I have found the stomachs of herrings sent to me from the West Coast for examination filled with little else than these Pteropods, numbers of which appear to have been swallowed wholesale, as some of the shells were practically uninjured. *Clione*, which has no shell, is a northern species, and is a rare visitant to the Firth of Forth. All the three recorded instances of its occurrence happened during the winter months. This was probably owing to the temperature of the water at that season being more favourable to its wandering habits, or the specimens may have been carried south by currents coming down from the North Atlantic. Another point connected with the capture of the *Clione* is, that on the two occasions in which it occurred in the surface tow-net the surface of the sea was smooth or but slightly disturbed, but on the occasion when it was found in the bottom tow-net the weather was stormy and the sea rough.

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* It is pleasing to know that the little steamer belonging to the Fishery Board for Scotland has had some share in promoting this advance, though perhaps the time has not yet come for the full appreciation of the *Garland's* work.

(2.) THE CRUSTACEA.

(*a*) DECAPODA.

The Decapoda captured by the tow-nets comprised the following species :—

Macropodia rostrata (Linn.),
Crangon allmanni, Kinahan,
Egeon fasciatus, Risso,
Cheraphilus nanus (Kroyer),
Hippolyte varians, Leach,
Hippolyte fascigera, Gosse,
Spirontocaris pusiola (Kroyer),
Pandalus montagui, Leach,
Pandalus brevirostris, Rathke,

all of which, with the exception of the first, belong to the Carida. They were all captured in the bottom net at various times and at one or more of all the selected stations.

Macropodia is only recorded twice during the seven years—once in October 1890, from Station IV., and again from the same station in August 1891.

Crangon allmanni occurred more frequently than any of the Decapods mentioned, and there are records of its capture with the bottom tow-nets in all but one of the seven years, 1889 being the only year in which no distinct record of the species occurs. In 1890 it is recorded twice, once in February and once in November, both records being for Station V. It is also recorded twice in 1891, once in March for Station V. and in September for Station III. There are seven records for 1892—viz., in January, March, and November for Station I., in February for Station III., in February for Station IV., and in January and February for Station V. There is only one record for 1893—viz., one for Station V. in

November. In 1894 there are three records, one in February for Station IX., and in August one each for Stations I. and III. In 1895 there are six records, one in February for Stations III., IV., V., and VIII., and one in September for Stations VIII. and IX., or twenty-one records in all for this species of Crangon. Nine (or nearly 43 per cent.) of the records are for February alone, and if those for January and November are included they amount to two-thirds of the whole number, the other records being divided almost equally among the three months March, August, and September.

Egeon (*Crangon*) *fasciatus* is only recorded once during the seven years—viz., for Station III. in September 1891.

Cheraphilus (*Crangon*) *nanus*. There are several records of this species during the prescribed period. Three of these occur in 1891, one in March for Station I. and one in the same month for Station V. The third record occurs in September for Station III. In 1892 there are four records, two for Station I. in January and March, one for Station III. in February, and one for Station V. in January. There is one in February 1894 for Station III., and one in the same month of 1895 for Station VIII., or nine records in all for *Cheraphilus nanus*, and, with the exception of the one in September for Station III., they all occur in the colder months.

Hippolyte varians. There is but one record of this species—viz., in December 1890 for Station V.

Hippolyte fascigera. This species is recorded for Station VIII. in January 1894, and in February 1895 for the same station.

Spirontocaris (*Hippolyte*) *pusiola* is recorded only once—viz., in February 1895 for Station IV.

Pandalus montagui (= *P. annulicornis* of Bell's *Stalk-eyed Crustacea*). The number of records for this species is seven, one for Station VIII. in February 1890; one in September 1891 for Station III. In 1892 there is one record in January for Station I. and also for Station V., and one in February for Station III. In 1893 there is one for Station V. in November, and one in February 1895 for Station VIII.

Pandalus brevirostris. For this species there are two records, and both are for 1891; one is for Station V. in March, and the other for Station III. in September.

It thus appears that nine species of named Decapod Crustacea have been captured during the six years from 1890 to 1895 (one or two Decapods are recorded for 1889, but only by their generic names, and are therefore not included here). These nine species were all captured with the bottom tow-net—not a single instance is recorded of the occurrence of any of them in the surface nets. The records for the whole nine species for the six years number 46. They are tabulated under eight out of the twelve months, and are characterised by the great majority of them being included in the statistics for the five months that are usually the colder months of the year. The subjoined formulæ will show some of these details more clearly:—

(1) The months in which the capture of Decapoda are recorded	Jan.	Feb.	Mar.	Aug.	Sept.	Oct.	Nov.	Dec.
Number of records for each of the months for the seven years	7	17	6	3	7	1	4	1

(2) The Stations where the Decapoda were captured	I.	III.	IV.	V.	VIII.	IX.
Number of records for each station	7	11	5	13	7	3

The number of records for February alone is 17, or 27 per cent. of the whole; and the number for the five colder months, January, February, March, November, and December, is 35, or fully 76 per cent. The reason that these Decapods are found usually in the bottom tow-nets, and not in those worked at the surface, is that they are veritable bottom feeders; and were it not for their peculiar habit of springing upward as well as backward when disturbed, their capture would be much less frequent. When any suspicious object is approaching these Crustaceans (I refer to the Carida or "shrimp" group) they face round towards it and intently watch its movements, and at the same time swim gently backwards, or they may at once bury themselves in the sand or mud. If the danger, however, should approach them suddenly, they spring quickly backwards and also obliquely upwards, and it is then that they come within the sweep of the bottom tow-net. But though the occurrence of these organisms in the bottom tow-net may be thus more or less satisfactorily explained, the reason for their being captured chiefly during the colder months seems to be less easy of explanation. It may be observed, however, that only five of the records are for the inshore station, and that about half of the total number are for Stations III. and V., the two stations in the middle of the estuary, the one extending east from Inchkeith the other west from May Island.

(*b*) SCHIZOPODA.

The Schizopoda are well represented as regards the number of species, and a few of them, especially those of the Euphausiidæ, appear to have been at times pretty numerous at the station under consideration. The Schizopods referred to in the records and distinguished by their names are the following:—*

EUPHAUSIIDÆ.

Boreophausia raschii (M. Sars).
Thysanoessa neglecta (Kroyer).

MYSIDÆ.

Siriella jaltensis, Czern. (=Siriella crassipes, G. O. Sars).
„ *armata* (M. Edw.).
Gastrosaccus spinifer (Goës).
Heteromysis formosa, S. I. Smith.
Erythrops goësii, G. O. Sars.
Mysidopsis didelphys (Norman).
„ *gibbosa*, G. O. Sars.
„ *angusta*, G. O. Sars.
Leptomysis gracilis, G. O. Sars.
„ *lingoura*, G. O. Sars.
Hemimysis lamornæ (Couch).
Macropsis slabberi (Van Ben.).
Praunus flexuosus (Müller). (= *Mysis chamæleon*, Varg.).
„ *inermis* (Rathke).
Schistomysis spiritus, Norman.
„ *ornata* (G. O. Sars).
Neomysis vulgaris (J. V. Thompson).

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* The names and their arrangement are in accordance with Rev. A. M. Norman's revision of the British Schizopoda, published in the 'Annals and Magazine of Natural History' for June, August, and September 1892.

Owing to the difficulty of distinguishing the species of Schizopoda offhand, their occurrence is frequently recorded in the lists of tow-net fauna simply under the family names, "Ephausiidæ" or "Mysidæ," or the generic names "Boreophausia sp.," "Mysis sp.," as the specimens observed happened to belong to either group; and before taking up the consideration of the detailed species, it is proposed to consider briefly the distribution of the Schizopoda under these names, as follows:—

THE EUPHAUSIIDÆ.—The records of the Schizopoda under the name of Euphausiidæ or *Boreophausia* sp. amount to one hundred and twelve for the seven years, and taking the one year with the other, they are distributed over all the twelve months; but the largest number occur in the first four and the last three months, as indicated by the Table annexed, which shows the number of the records of the Euphausiidæ that are referred to simply under their family or generic names for each station, and for each month of the year for all the seven years.

TABLE I., showing the Distribution of the Euphausiidæ, as indicated by the Records for the Years, Months, and Stations:—

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Totals for the Years.	Years.	I.	III.	IV.	V.	VIII.	IX.	
1889, .	1	–	–	–	–	1	1	1	–	1	–	–	5	1889, .	2	–	–	2	–	1	5
1890, .	–	3	6	3	–	–	3	–	–	3	2	1	21	1890, .	2	5	2	6	3	3	21
1891, .	4	3	2	1	7	4	–	–	–	–	–	1	22	1891, .	4	7	5	2	4	–	22
1892, .	3	4	5	2	4	–	1	–	1	–	–	–	20	1892, .	2	5	1	3	3	6	20
1893, .	7	4	–	1	–	–	–	–	1	4	4	6	27	1893, .	5	7	3	6	3	3	27
1894, .	2	6	–	1	–	–	–	–	–	–	–	1	10	1894, .	3	1	1	2	2	1	10
1895, .	–	2	–	–	–	–	–	–	–	1	–	5	8	1895, .	1	3	1	–	1	2	8
Totals for the Months,	17	22	13	8	11	5	5	1	2	9	6	14	113	Totals for the Stations,	19	28	13	21	16	16	113

Of these records thirty-one are for the Euphausiidæ observed in the surface tow-nets, while the other eighty-one are bottom tow-net records. In few of the surface gatherings were Euphausiidæ frequent or common, but in a number of the gatherings collected with the bottom tow-nets they were fairly numerous. The results brought out by these Tables regarding their distribution are referred to further on in connection with the detailed account of the different species.

Meanwhile I proceed to notice the records of the second group of the Schizopoda as they appear under the general name of *Mysis* sp. or Mysidæ. I find that there are only thirty-three separate notices of Mysidæ, and three of these are entered under the name *Leptomysis* sp. The reason for this is that most of the Mysidæ were usually not so plentiful, and were identified at the time or shortly after they were collected. The records of Mysidæ, though few in number, show a distribution very similar to the Euphausiidæ—that is, they occur chiefly among the statistics for the colder months. There are no records of Mysidæ for the three summer months, while those for February, November, and December are together equal to 71 per cent. of the whole number. I shall now leave these more general groups for the present, and proceed to consider the distribution of those forms recorded under distinctive specific names.

(*i.*) *The Euphausiidæ.*

Boreophausia raschii. The records of this species are comparatively few, and are all included in the statistics for 1889 and 1890. In 1889 there are eleven records of this species, one each for Stations I., III., and IV. in January, one each for Stations I. and V. in February, and one each for all the six stations in November. There are three records for 1890, one each for Stations I. and VIII. in February, and one for Station IV. in March.

Thysanoessa neglecta. This is the Schizopod that is usually referred to in the records as "*Thysanoessa* sp." It was observed in 1891 at Station III. in October, and again at the same station in November; it was also observed in November at Stations V. and VIII. In 1892 the records for *Thysanoessa* are as follows:—For Station I. in September, and again in November and December; for Station III. in December, and in the same month at Station IV.; at Station V. in October, and again in November and December; once at Station VIII. in October, and on two different occasions in December (on one of these occasions the species was observed in both the surface and bottom tow-nets); at Station IX. it was also taken twice in December, one on the 2nd and again on the 22nd. There are only two records for *Thysanoessa* in 1893—viz., in January for Station III. and in September for Station I. The only records in 1894 are two in December, when the species was taken in both the surface and bottom tow-nets at Station III. In 1895 there is no distinct record for *Thysanoessa*, and it probably was not observed during that year.

(*ii.*) *The Mysidæ.*

Siriella jaltensis. (This is equal to *S. crassipes*, G. O. Sars, of earlier papers.) There is but one record for this among the faunal lists for the seven years; it was obtained at Station V. in March 1893.

Siriella armata is another species that is seldom met with in the Firth of Forth, and only one record of it is published in the lists of tow-net fauna of the selected stations; it occurred at Station III. in March 1892.

Gastrosaccus spinifer. There are records of this species from one or other of the selected stations for all the seven years except 1891. The first record is for Station VIII. in November 1889. In 1890 the species is recorded for Station VIII. in December, and for Station IX. in August. In 1892 for Station I. in January, and Station V. in March. There is only one record in 1893—viz., for Station I. in January, and one in 1894 for Station III. in February. In 1895 there are two records, one for Station III. in February, and one for Station VIII. in December.

Heteromysis formosa is one of the rare species recorded for the Firth of Forth, and has only been observed twice during seven years—viz., at Station I. in August 1894, and at Station IV. in February 1895.

Erythrops goësii. This Mysid, though not known to occur in Britain previous to the institution of the Board's scientific investigations, is the most common of the Mysidæ in the seaward part of the Forth estuary, and there are several records of it for all the selected stations. In 1889 it is recorded in January for Station III., in February for Station I., and in November for Station VIII. In 1890 there are records of it for Station I. in October and November; for Station V. in February, September, November, and December; for Stations VIII. and IX. in February, and again in April; for Station IX. in August; and for Station VIII. in December. In 1891 the records include one for Station I. in March, and for Station III. in September and November, and for Station V. in March and Station VIII. in June. In 1892 *Erythrops* is recorded for Station I. in January, March, and November, and for Station III. in February. It is also recorded for Station V. in January, February, March, May, September, and December; for Station VIII. once in March and September, and twice in December; and for Station IX. in May, July, and December. The records for 1893 are comparatively few in number, and include one for Station III. in December, one for Station V. in March and November, for Station VIII. in December, and Station IX. in February and October. In 1894 there are only three records, one for Station III. in February, and two for Station V., one each in February and August. There are several records for 1895, and they are distributed as follows:—One for Station I. in April, one for Station III. in February, and again in October, one for Station V. in February, one for Station VIII. in February, May, and December, one for Station IX. in April, and one each for Stations VIII. and IX. in September. The annexed Tables show (1) the number of records for the months and years and (2) the number for the years and stations.

TABLE II., showing the Distribution of *Erythrops goësii*, as indicated by the Records for the Years, Months, and Stations:—

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Total for each Year.	Years.	I.	III.	IV.	V.	VIII.	IX.	Total for each Year
1889, .	1	1	-	-	-	-	-	-	-	-	1	-	3	1889, .	1	1	-	-	1	-	3
1890, .	-	3	-	2	-	-	-	1	1	1	2	2	12	1890, .	2	-	-	4	3	3	12
1891, .	-	-	2	-	-	1	-	-	1	-	1	-	5	1891, .	1	2	-	1	1	-	5
1892, .	2	2	3	-	2	-	1	-	2	-	1	4	17	1892, .	3	1	-	6	4	3	17
1893, .	-	1	1	-	-	-	-	-	-	1	1	2	6	1893, .	-	1	-	2	1	2	6
1894, .	-	2	-	-	-	-	-	1	-	-	-	-	3	1894, .	-	1	-	2	-	-	3
1895, .	-	3	-	2	1	-	-	-	2	1	-	1	10	1895, .	1	2	-	1	4	2	10
Total for each Month,	3	12	6	4	3	1	1	2	6	3	6	9	56	Totals for the Six Stations,	8	8	-	16	14	10	56

Mysidopsis didelphys. There are only three records for this species, one for Station VIII. in December 1890, and two in March 1891—one for Station I. and another for Station V.

Mysidopsis gibbosa is recorded for Station III. in January 1889; for Station IX. in August 1890; for Station I. in March 1891, and for Station III. in January and September of the same year. In 1892 there is a record for Station I. in January and Station IV. in March, while the only record in 1894 is one for Station III. in February.

Mysidopsis angusta. The only records of this species are all for 1890 except one, and comprise one for Stations I. and III. in October, and one for Station V. in October, November, and December in 1890, and one for Station III. in 1891.

Leptomysis lingoura is recorded once during the seven years—viz., for Station III. in March 1892.

Hemimysis lamornæ. This Schizopod is recorded three times in 1892—viz., twice for Station I., once in January and once in March, and for Station IX. in December. The species is recorded again in 1893 for Station V. in January, and in 1895 for Station III. in February and Station VIII. in December.

Macropsis slabberi, remarkable among British Schizopods for the length of the eye-stalks, is of frequent occurrence over a considerable portion of the Forth estuary, and specially in the upper reaches. While several of the species mentioned here may be regarded as only visitors, this appears to be a resident, at least in that part of the Firth which extends westward from Queensferry. In this part of the Forth, which may be considered the headquarters of the species on the East Coast of Scotland, it may sometimes be found in large numbers, and its presence seaward may be due to the overcrowding in these waters causing a greater amount of migration to take place, though it is also possible that the species may be resident in the seaward as well as the landward part of the Firth. The records of the species that have to be noted in connection with the present inquiry are the following:—The first reference to *Macropsis* occurs in February 1890 for Station IV., and again for the same station in March. There is no further record of it till October, when it is again recorded for that station and also for Stations I. and III. It is again recorded for the same three stations in November, and the November record for Station IV. is for both surface and bottom tow-nets, while the others are for the bottom tow-nets only. In 1891 there are records of this species for Stations III. and IV. in January, for Stations I. and III. in October, and in the same months for Station IV. The October record for Station IV. is for the surface tow-net. In July of the same year *Macropsis* is recorded as frequent in a surface tow-net gathering at Station VIII. in July, which seems to indicate a considerable migration of the species seaward, either from the upper parts of the estuary or elsewhere. In 1892 it is recorded for Station I. in January and for Station IV. in March. In 1893 the first record is for Station IV. in January, while the next records are for Stations I. and III., the first being for November, the other for October. There are no records of *Macropsis* for 1894. The records for 1895 include one for Station III. in February and another for the same station in October. There is one for Station IV. in February, and two for the same station in October, one for the surface tow-net and one for the bottom tow-net; and another for the same station in December.

Praunus flexuosus. This species, which is more familiar by its older name of *Mysis chamæleon* or *Mysis flexuosa,* is, though a common one, infrequent among the tow-net invertebrates from the selected stations. In 1892 it is recorded for Station IV. in January and March; in 1893 for Station III. in December; in 1894 for Station III. in February; and in 1895 for Station IV. in January, and for the same station in February. *Praunus flexuosus* was observed only among bottom tow-net gatherings.

Praunus (*Mysis*) *inermis.* The only records for this species occur in 1895, in February, and comprise one each for Stations V., VIII., and X., all being bottom tow-net gatherings.

Schistomysis spiritus. This species is recorded for Station IX. in November 1889; for Station I. in October 1890; and in the same year for Station V. in November and December. In 1891 it is recorded for Station I. in March, for Station IV. in January, and for Station V. in November. There are no records for 1892. In 1893 there is a record for Station III. in January, and one in February 1894 for the same station. There is no record of *S. spiritus* for 1895.

Schistomysis ornata. This, which is one of the most richly coloured of the British Mysidæ, is also at times moderately frequent in the Firth of Forth, and there are several records of its occurrence at most of the selected stations. The first record is for Station I. in August 1889. In 1890 there are records of it for Station I. in October, for Station V. in February, November, and December, for Station VIII. in February, April, and December, and for Station IX. in February and October. In 1891 it is recorded for Station I. in March, and for Station III. in September. It is also recorded for Station IV. in March and November. In 1892 it is recorded in January and March for the two Stations I. and V. There are no records for 1893. In 1894 it is recorded for Station III. in February. In February 1895 it is again recorded for Station III., and for Station IV. in January. All the records are only for bottom tow-nets.

Neomysis vulgaris. The only record for this species is one for Station IV. in December 1892, from the surface tow-net.

Table III. shows the distribution of the whole of the species of Mysidæ referred to in the preceding notes for the years and months and also for the stations; while Table IV. shows, in the same way, the distribution of the whole of the Schizopoda.

TABLE III., showing the Distribution of all the species of Mysidæ for the Years, Months, and Stations.

Years.	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Totals for the Years.	Years.	I.	III.	IV.	V.	VIII.	IX.	Totals for the Years.
1889, .	2	1	–	–	–	–	–	1	–	–	3	–	7	1889, .	2	2	–	–	2	1	7
1890, .	–	7	1	3	–	–	–	3	1	10	9	8	42	1890, .	7	3	5	12	8	7	42
1891, .	4	–	9	–	–	1	1	–	3	4	3	–	25	1891, .	7	8	5	3	2	–	25
1892, .	8	3	12	–	2	–	1	–	2	–	1	6	35	1892, .	10	3	5	9	4	4	35
1893, .	4	1	2	–	–	–	–	–	–	2	2	3	14	1893, .	2	4	2	3	1	2	14
1894, .	–	7	–	–	–	–	–	2	–	–	–	–	9	1894, .	1	6	–	2	–	–	9
1895, .	2	13	–	1	1	–	–	–	2	4	–	4	27	1895, .	1	7	8	2	7	2	27
Totals for the Months,	20	32	24	4	3	1	2	6	8	20	18	21	159	Totals for the Stations,	30	33	25	31	24	16	159

TABLE IV., showing the Distribution of the Schizopoda, as indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Numbers of the Records for each Month of each Year.												Number of Records for years and stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	1	1	–	–	–	–	–	1	–	–	1	–	4
	1890, .	–	1	1	–	–	–	–	–	–	1	–	1	4
	1891, .	1	1	1	1	–	–	–	–	–	1	–	–	5
	1892, .	1	1	1	–	–	–	–	–	1	–	1	1	6
	1893, .	2	1	–	1	–	–	–	–	2	1	1	–	8
	1894, .	1	1	–	–	–	–	–	1	–	–	–	1	4
	1895, .	–	–	–	1	–	–	–	–	–	–	–	1	2
Number of Records for all the Months,		6	6	3	3	–	–	–	2	3	3	3	4	33
III.	1889, .	1	–	–	–	–	–	–	–	–	–	1	–	2
	1890, .	–	1	1	1	–	–	1	–	–	1	–	1	6
	1891, .	1	1	–	2	–	2	–	–	1	1	1	1	10
	1892, .	–	1	1	2	–	–	–	–	–	–	–	1	5
	1893, .	1	2	–	–	–	–	–	–	–	1	2	2	8
	1894, .	–	1	–	–	–	–	–	1	–	–	–	3	5
	1895, .	–	1	–	–	–	–	–	–	–	1	–	1	3
Number of Records for all the Months,		3	7	2	5	–	2	1	1	1	4	4	9	39
IV.	1889, .	1	–	–	–	–	–	–	–	–	–	1	–	2
	1890, .	–	1	2	–	–	–	1	–	–	1	–	2	7
	1891, .	1	1	1	1	–	–	–	–	–	1	1	–	6
	1892, .	–	1	1	–	–	–	–	–	–	–	–	1	3
	1893, .	2	–	–	–	–	–	–	–	–	1	1	–	4
	1894, .	–	1	–	–	–	–	–	–	–	–	–	–	1
	1895, .	1	1	–	–	–	–	–	–	–	2	–	2	6
Number of Records for all the Months,		5	5	4	1	–	–	1	–	–	5	3	5	29

TABLE IV.—*continued.*

Three Outer Stations.	Years.	Number of Records for each Month of each Year.												Number of Records for years and stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	–	1	–	–	–	1	–	1	–	1	1	–	5
	1890, .	–	1	–	–	–	–	–	–	1	1	1	1	5
	1891, .	–	–	1	1	1	–	–	–	–	–	1	–	4
	1892, .	1	1	1	1	–	–	–	–	1	1	1		8
	1893, .	2	–	1	–	–	–	–	–	–	1	1	1	6
	1894, .	–	1	–	1	–	–	–	1	–	–	–	–	3
	1895, .	–	1	–	–	–	–	–	–	–	–	–	–	1
Number of Records for all the Months,		3	5	3	3	1	1	–	2	2	4	5	3	32
VIII.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	1	1	1	–	–	–	–	–	–	–	1	4
	1891, .	–	–	–	1	1	2	1	–	1	–	1	–	7
	1892, .	–	1	–	1	1	–	–	–	1	1	–	3	8
	1893, .	1	–	–	–	–	–	–	–	–	–	–	2	3
	1894, .	1	1	–	–	–	–	–	–	–	–	–	–	2
	1895, .	–	1	–	–	–	–	–	–	1	–	–	1	3
Number of Records for all the Months,		2	4	1	3	2	2	1	–	3	1	2	7	28
IX.	1889, .	1	–	–	–	–	1	–	–	–	–	1	–	3
	1890, .	–	1	1	1	–	–	–	1	–	1	–	–	5
	1891, .	–	–	–	–	–	–	–	–	–	–	–	–	–
	1892, .	1	1	–	1	2	–	1	–	–	–	–	2	8
	1893, .	1	–	1	–	–	–	–	–	–	1	–	1	4
	1894, .	–	1	–	–	–	–	–	–	–	–	–	–	1
	1895, .	–	1	–	1	1	–	–	–	1	–	–	1	5
Number of Records for all the Months,		3	4	2	3	3	1	1	1	1	2	1	4	26

It will be observed from the various Tables, and also from what has been already stated concerning the distribution of these crustaceans in the Firth of Forth district, that, generally speaking, they are much more numerous in the winter and spring months than in summer; and not only is it the case that a greater variety of species appear to be present in the estuary during those colder months, but it is evident that some of them at least are also individually much more numerous. The recorded results of the *Garland* researches, even during that part of the year which seems to be most favourable to the presence of these organisms, shows that their movements are more or less erratic. On February 14, 1890, Euphausiidæ are recorded as "common" in a bottom tow-net gathering at Station V., but at Station VII., a little to the south of Station V., trawled the previous day, they are described as "very rare," while, on the other hand, the Mysidæ were more common, and in much greater variety, at this station. Moreover, at Station I., which is in line with Station V., but a little farther west, and also at Stations II., III., and IV., which were all tow-netted within a few days of each other, Euphausiidæ are either altogether absent from the tow-net lists or they are described as "rare." These Schizopods were again present in the Forth in considerable numbers in the following March; they were common at Stations I., III., IV., VIII., and IX., but few or rare at Stations II., V., VI., and VII. During the following summer Euphausiidæ were entirely absent from, or were very scarce in, the tow-net gatherings which were then collected; but the records for the ensuing month of October describe these organisms as frequent at some of the stations during that month, and they continue to be represented in the tow-net gatherings in varying numbers, from one or other of the stations, all through the winter and on to the spring of 1891. During the summer and winter months of that year comparatively few records of the Euphausiidæ occur in the lists of tow-net gatherings, and not till the beginning of 1892 is there much increase in the number of the records; but, though in February and March there is a decided increase, the captures of them even then are usually described as "few" or "rare." With one or two exceptions, Schizopods continued to be scarce in the tow-net gatherings till the winter of 1893-94, when they appear to have become more than usually numerous, and, in a considerable proportion of the gatherings collected during December and January of that winter, they are referred to as "common" or "frequent." With the advent of summer, however, and from that time on into 1895, the numbers of these crustaceans are again considerably reduced. From a study of all the facts at our disposal in the published records in the Fishery Board's Annual Reports for 1889 to 1896, there seems to be a fair amount of evidence tending to show the existence of a more or less regular yearly increase and decrease in the numbers of Schizopoda present in the estuary of the Forth, but the reason of this increase and decrease is not sufficiently clear to permit at present of a satisfactory explanation.

Besides this apparent yearly variation referred to, there also appears to be a fluctuation, which may or may not be regular, that extends over a longer time. I refer to the presence of Schizopoda in considerable numbers in the winter of 1889-90, and again in the winter of 1893-94; but to ascertain whether this variation is merely accidental or not would have required the investigations to be carried on over a much longer period than they have been. In considering this question of the seasonal variations of the Schizopoda, I have dealt mainly with the Euphausiidæ, because this family is the one most numerously represented in the Firth of Forth, and the one which has shown the greatest tendency to a regular periodic increase and decrease. The Mysidæ, also, to some extent show a similar tendency to variation, but the variation is scarcely so well marked as in the case of Euphausiidæ.

(c) CUMACEA.

The species of the Cumacea which have been identified are :—

Iphinoë trispinosa (Goodsir).
Cumopsis goodsiri (V. Beneden).
Leucon nasicus, Kroyer.
Eudorella truncatula (Spence Bate).
Diastylus rugosa, G. O. Sars.
Pseudocuma cercaria (V. Beneden).
Campylaspis rubicunda, Lilljeborg.
Petalosarsia declivis, G. O. Sars.

Others are recorded simply under the family or generic names. As these crustaceans usually live on or close to the bottom of the water, the records of them in the tow-net lists are, as might be expected, comparatively few, and may be briefly stated as under :—

Iphinoë trispinosa is only recorded for Station I. in July 1889, and for the same station in February and July in 1890.

Cumopsis goodsiri. The only record for the species is for Station III. in September 1891.

Leucon nasicus. In 1890 this species is recorded for Station I. in April, for Station V. in March, and for Station VIII. in December; in 1892, for Station V. in April, and for Station VIII. in May 1895.

Eudorella truncatula. The records for this species are four in number, one for Station V. in September and one for Station VIII. in December 1890; one for Station I. in February 1892, and one for the same station in June 1893.

Diastylus rugosa is recorded under its full name only for Station I. in April 1890, and for Station V. in March 1891; but there are several records of *Diastylus* sp. included in the additional references to the group under the more general name of Cumacea, etc.

Pseudocuma cercaria. This is a moderately common Cumacean, though, for the reason stated about the habits of these creatures, its name does not occur very frequently in the lists of tow-net fauna. The records are as follows:—In 1890 there are four in April—viz., one for Stations I., V., VIII., and IX., and it is recorded again for Station IX. in August and October. In 1891 there is a record for Station IX. in February, and for the same station again in September, and there is also one for Station VIII. in September. In 1892 there is a record for Station I. in January, and again for the same station in September. There is only one record for 1893—viz., for Station VIII. in April. In 1894 there are records of *Pseudocuma* for Station V. in August, and for Station IX. in February and April; and in 1895 for Station I. in April and October, for Station III. in October, for Station V. in April and August, and in the same two months for Station IX.

Campylaspis rubicunda. This species, which at that time had not been recorded for Britain, was observed at Station IX. in April 1893, and at Station V. in 1894.

Petalosarsia declivis, another rare Cumacean, was observed at the same time and place as *Campylaspis.* This concludes the records of the named species, but there are several other records of Cumaceans under the more general names of Cumacea, *Cuma*, etc., which I shall now refer to.

The records of Cumaceans under these general names are as follows:—In 1890 the first is for Station V. in March; in April there are records for Stations III., VIII., and IX., and for Station VIII. in December. In 1891 the records are—one for Station VIII. in February, for Station I. in March, for Station VIII. in April, and for Station III. in November. In 1892 there is a record for Station VIII. in March, for Station IX. in May, for Stations V. and IX. in July, for Station VIII. in September, and for Station IX. in December. In 1893 there are four records of Cumacea—viz., two in June for Stations I. and V., one in August for Station V., and one in October for Station IX. The only records in 1894 are—one for Station V. in February, and another for Station IX. in the same month. There are five records in 1895, one for Station IV. in February, one for Stations III., VIII., and IX. in February, and one for Station VIII. in December.

There does not appear to be any feature of special interest in the distribution of the Cumacea as brought out by the published records, except that a few of the species are rare or new in the British seas.

(*d*) ISOPODA.

The next group of organisms that fall to be noticed is the Isopoda. This group is represented in the tow-net lists by six species, the names of which are as follow:—

Gnathia (?) *maxillaris* (M. Edw.).
Eurydice pulchra, Leach.
Idothea baltica (Pallas).
Idothea emarginata (Fabr.).
,, *linearis* (Linn.).
Janira maculosa, Leach.

With the exception of *Idothea baltica*, these Isopods were all extremely rare in the tow-net gatherings under consideration, and the records for them are as under:—

Gnathia (?) *maxillaris* is recorded once in 1890, for Station VIII. in March.

Eurydice pulchra is recorded in the same year for Station III. in November.

Idothea baltica is recorded in 1889 for Station VIII. in February, and for Station IX. in January. In 1890 the same species is recorded in April for Stations IV. and V., and again for Station V. in October. In 1891 it is recorded for Station I. in January and April, and for Station IV. in March. It is recorded again for Station IV. in May 1892. In 1893 it is recorded in February for Station III., and in November for Stations I. and IV. In 1894 there is one record—viz., for Station IV. in April. In 1895 this Isopod is recorded in April for Stations I., III., IV., V., and VIII., and for Station V. in September. It will be seen that nine out of the nineteen records of *Idothea baltica*, or fully 47 per cent., are for the month of April; and it has also further to be noted that, curiously enough, the whole number of the records, with only a single exception, are from surface tow-net gatherings.

Idothea linearis. There is only one record for this species—viz., for Station IV. in January 1893.

Idothea emarginata. There is also only one record for this species—for Station I. in May 1891.

Janira maculosa is also only recorded once, for Station IX. in April 1890.

TABLE V., showing the Distribution of the Isopoda :—

Stations.	Years.	Months.												Total for Years.	Total for Stations	
		Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.			
I.	1891	1	–	–	1	1	–	–	–	–	–	–	–	3	5	Three Inner Stations.
	1893	–	–	–	–	–	–	–	–	–	–	1	–	1		
	1895	–	–	–	1	–	–	–	–	–	–	–	–	1		
III.	1890	–	–	–	–	–	–	–	–	–	–	1	–	1	3	
	1893	–	1	–	–	–	–	–	–	–	–	–	–	1		
	1895	–	–	–	1	–	–	–	–	–	–	–	–	1		
IV.	1890	–	–	–	1	–	–	–	–	–	–	–	–	1	7	
	1891	–	–	1	–	–	–	–	–	–	–	–	–	1		
	1892	–	–	–	–	1	–	–	–	–	–	–	–	1		
	1893	1	–	–	–	–	–	–	–	–	–	1	–	2		
	1894	–	–	–	1	–	–	–	–	–	–	–	–	1		
	1895	–	–	–	1	–	–	–	–	–	–	–	–	1		
V.	1890	–	–	–	1	–	–	–	–	–	1	–	–	2	4	Three Outer Stations.
	1895	–	–	–	1	–	–	–	–	1	–	–	–	2		
VIII.	1889	–	1	–	–	–	–	–	–	–	–	–	–	1	3	
	1890	–	–	1	–	–	–	–	–	–	–	–	–	1		
	1895	–	–	–	1	–	–	–	–	–	–	–	–	1		
IX.	1889	1	–	–	–	–	–	–	–	–	–	–	–	1	2	
	1890	–	–	–	1	–	–	–	–	–	–	–	–	1		
Total for Months,		3	2	2	10	2	–	–	–	1	1	3	–	24	24	

(*e*) AMPHIPODA.

We shall now proceed to consider the Amphipoda recorded in the lists of tow-net fauna, and at the very outset we meet with a marked differentiation in regard to the distribution and numbers of certain of the species. Twenty-two species of the Amphipods mentioned in the lists of tow-net gatherings are more or less fully defined by name. The distribution, as regards the numbers and the frequency of three of the species, is so different from the others as to indicate a more or less decided difference in their habits and mode of life. The three species I refer to are *Hyperia galba*, *Hyperoche tauriformis* (Spence Bate), and *Parathemisto oblivia*. Moreover, while these three differ more or less distinctly from the other Amphipods mentioned in the tow-net lists, they are also in their own habits somewhat dissimilar to each other. *Parathemisto*, for example (and perhaps also *Hyperoche*), is to a large extent a free-swimming species; on the other hand, the *Hyperiæ* are also characterised as messmates of large Medusæ, and live a considerable part of their lives under the shelter afforded them by these curious organisms. Hence the distribution of *Hyperia* in the Firth of Forth depends to some extent on the presence or absence of Medusæ, whereas *Parathemisto* being a "free swimmer," its movements are not so limited as those of the other.

The following is a list of the Amphipods referred to by name in the lists of tow-net fauna:—

Hyperia galba (Montagu).
Hyperoche tauriformis (Bate).
Parathemisto oblivia (Kroyer).
Euthemisto (?) *compressa* (Goës).
Callisoma crenata (Bate).
Hippomedon denticulatus (Bate).
Bathyporeia sp.
Ampelisca sp.
Stenothoë marina (Bate).
Argissa hamatipes (Norman).
Metopa alderi, Bate.
Perioculodes longimanus (Bate).
Iphimedia obesa, Rathke.
Apherusa bispinosa (Bate).
,, *borealis* (Boeck).
Paratylus swammerdami (M. Edw.).
Dexamine sp.
Melphidippella macera (Norman).
Amathilla homari (Fabr.).
Gammarus sp.
Gammaropsis erythrophthalma, Lillj.
Pariambus typicus (Kr.).

As it is not my intention to describe in detail the distribution of all the Amphipods named in the list, I shall confine my remarks chiefly to the Hyperiidæ, because of their great importance both numerically and as fish food.

Hyperia galba. This Amphipod is occasionally present in the Firth of Forth, but usually in limited numbers, and the records of its occurrence seem to indicate that it is as frequently captured by the bottom tow-net as it is by the surface net. In 1889 the records of it for the selected stations are very few. It is recorded in the bottom tow-net lists for July, and again in November. The November record describes it as common. It is recorded for Station V. in August and November, and described as frequent in the bottom tow-net gatherings and few in the November surface-net gatherings; and it occurred sparingly in the bottom tow-net gatherings from Stations VIII. and IX. in August. But the infrequency of the records of this and other species in 1889 is no doubt partly due to there being no lists of tow-net fauna for March, April, and May (with one exception—viz., for Station V. for surface net in May), and for nearly all the months of October and December. In 1890, though there are frequent records of the occurrence of Amphipods under the name of *Hyperia* sp., *H. galba* is only two or three times noted, once in February for Station I., in July for Station III., and in December for Station VIII. The species referred to under the name of *Hyperia* sp. is probably *Hyperoche tauriformis*, recorded in 1891 *et seq. ann.* In 1891 no direct reference to *Hyperia galba* occurs among the tow-net faunal lists. There are five records in 1892, but one or two of them are doubtful. In 1893 there are two records for Station III., one in August and one in November, that appear to refer to *Hyperia galba.* There are no records of it in 1894, but there are eight in 1895, one for Station I. in October and December, two (one surface and one bottom) for Station III. in October, one for Station IV. in August and October, one for Station V. in September, and one for Station VIII. in October.

Hyperoche tauriformis. This species, which is the *Hyperia tauriformis* of Spence Bate, was recognised as a member of the Forth fauna in 1891, and has been observed more or less frequently every year since. In previous tow-net tests it was recorded simply as *Hyperia* sp., and the records of Amphipoda under that name in Part III. of the Annual Reports probably refer chiefly to *Hyperoche*, though they may also occasionally include immature forms of *Hyperia galba* which could not at the time be otherwise satisfactorily disposed of. In the Report for 1891 there are about fourteen to sixteen records of this Amphipod, chiefly from Stations V., VIII., and IX. In 1892 there are eighteen records. They extend over nearly all the stations, and the majority of them are for the autumn and winter months. The following are the records for 1892 :—For Station I. in November and December; for Station III. in July, October, and November; for Station IV. in October, November, and December; for Station V. in February and March, and again in October and November; for Station VIII. in July, October, and November; and for Station IX. in October and December. In 1893 the number of records for *Hyperoche tauriformis* is fourteen. It was recorded for Station I. in January, June, August (surface and bottom tow-nets), and September (surface and bottom tow-nets); for Station III. in June (surface and bottom tow-nets); for Station V. in August and September; for Station VIII. in July and September; and for Station IX. in January and August. There are ten records in 1894—viz., for Station I. in August and November; for Station III. in June, August (surface and bottom tow-nets), and in November (surface and bottom tow-nets); for Station IV. in February, and for Station V. in June and August. In 1895 there are eighteen records, divided as follows :—One for Station I. in October and December (for surface and bottom tow-nets); for Station III. in February, August, October (for surface and bottom tow-nets), and December (also for surface and bottom tow-nets); for Station IV. in October (for surface and bottom tow-nets) and December (also for surface and bottom tow-nets); for Station V. in February; for Station VIII. in February, October, and December; and for Station IX. in December.

Parathemisto oblivia. This Amphipod was more common and more generally distributed in the estuary than any of the other species, and it is one of the species that enter largely into the food of certain fishes, as the herring. At times the stomachs of herring contain large numbers of this crustacean.

In 1889—the first of the series of seven years—the records of *Parathemisto* are few, there being only seven for the whole of the year; but there are, as already explained, several of the months of 1889 for which there are no lists of tow-net fauna, and this no doubt accounts to a considerable extent for the records for that year being so few in number. Among the records for 1889 there is one for Station I. in January and another for Station IV.; for Station V. the records are, one in January and two in February, and one also for Station VIII. in January, and for Station IX. in January and November.

In 1890 there are comparatively few records. *Parathemisto* was scarce in the surface and bottom tow-nets. For Station III. in April (in the surface tow-net), and at Station I. in May, it was rare; in the surface net for Station IV. in December; at Station V. it was obtained in April, November, and December. The December record includes both the surface and bottom tow-net gatherings. There are also the following records for Station VIII.—viz., two in April and December (surface and bottom tow-nets), and one in May and in August (bottom tow-net only). There are two records for Station IX., one in April and one in August.

In 1891 the records of *Parathemisto* are much more frequent than in the two preceding years. There are twelve records for Station I., one in January, two in February, March, and April, one in May, June, and October, and two in November. There are also twelve records for Station III., one in January, February, and April, two in May, one in June, August, and October, and two in November and December. There are ten records for Station IV., two in January, February, and March, one in April, two in May, and one in June. There are ten records for Station V., two in February and March, one in April and May, and two in November and December. The records for Station VIII. are two in February, one in June, and two in November; while those for Station IX. are two in February, and one in April, May, and November—the total number of records for 1891 being fifty-four.

The records of *Parathemisto* for 1892 include the following, viz.:—Two for Station I. (surface and bottom tow-nets) in January, February, and March, and one in April for the bottom tow-net, and in November and December for the surface tow-net. The records for Station III. are two in January, February, and March, and one in October, November, and December. For Station IV. there are two records for January, February, and March, and one for April, November, and December. For Station V. there is one in January and February, two in March, April, and October, and one in November and December. The records for Station VIII. are two in January, February, and March, one in May, June, July, and October, and two in December; and for Station IX. there are two records in July, February, and March, one in April, May, July, and October, and two in December. Altogether there are sixty records of *Parathemisto* for 1892, and over fifty of them occur in the first three and last three months of the year. It may also be noted that the records for Stations I., III., and IV. describe the species as common in the surface tow-nets in January or February, while the records for Stations VIII. and IX. describe it as common in the bottom tow-nets in January.

In 1893 the records of *Parathemisto* are much fewer in number than for the previous year. Those for Station I. are two in January and one in April, October, and November. For Station III. there is one in January, February, and October, and two in December. The December records describe *Parathemisto* as frequent in the surface and common in the bottom tow-net. For Station IV. there is one record in January, February, April, and May, two in October, and one in November. For Station V. there is one in February and June, and two in October and December. For Station VIII. there is one in January, April, May, and October, and two in December; while for Station IX. there is one in

April, two in October, and two in December. The October records for Station IX. describe the species as common in the surface tow-net and frequent in the bottom net, and in December as frequent in both nets There are in all thirty-four records of *Parathemisto* for 1893, twenty seven of them being for the first three or last three months.

In 1894 the number of records are as follow :—For Station I. there is one in February, two in April and August, and one in November. For Station III. there is one in February and April, two in August, one in November, and two in December. For Station IV. there is only one record—viz., for surface tow-net in February, in which *Parathemisto* is described as common. There are only two records for Station V.—viz., for surface and bottom tow-nets in February. There are three records for Station VIII., one in January and February, and one in April. The only record for Station IX. is one in February. The number of records of *Parathemisto* for 1894 is twenty, twelve of which are for the first two and last two months, the other eight being divided equally between April and August.

In 1895 the records for Station I. are one in February and two in December, and in the surface tow-net record for December *Parathemisto* is described as common. For Station III. there is one in February and April, and two in December. For Station IV. there is one record in February and one in December. There is one record in April for Station V. For Station VIII. there is one in February and April, and two in December; while for Station IX. the records are two in February and one in December—or seventeen records altogether for 1895, thirteen, or fully 70 per cent., of them being for the two months February and December.

The following Table shows the distribution of the records of *Parathemisto* as described in the preceding notes :—

TABLE VI., showing the Distribution of *Parathemisto*, as indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Months.												Total for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.	
I.	1889, .	1	–	–	–	–	–	–	–	–	–	–	–	1
	1890, .	–	–	–	–	1	–	–	–	–	–	–	–	1
	1891, .	1	2	2	2	1	1	–	–		1	2	–	12
	1892, .	2	2	2	1	–	–	–	–	–	–	1	1	9
	1893, .	2	–	–	1	–	–	–	–	–	1	1	–	5
	1894, .	–	1	–	2	–	–	–	2		–	1	–	6
	1895, .	–	1	–	–	–	–	–	–	–	–	–	2	3
Totals for the Months, ...		6	6	4	6	2	1	–	2	–	2	5	3	37

TABLE VI.—*continued.*

Inner Stations—*continued.*	Years.	Months.												Total for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
III.	1889, .	–	–	–	–	–	–	–	–	–	–	–	–	–
	1890, .	–	–	–	2	–	–	–	–	–	–	–	–	2
	1891, .	1	1	–	1	2	1	–	1	–	1	2	2	12
	1892, .	2	2	2	–	–	–	–	–	–	1	1	1	9
	1893, .	1	1	–	–	–	–	–	–	–	1	–	2	5
	1894, .	–	1	–	1	–	–	–	2	–	–	1	2	7
	1895, .	–	1	–	1	–	–	–	–	–	–	–	2	4
Totals for the Months, ...		4	6	2	5	2	1	–	3	–	3	4	9	39
IV.	1889, .	1	–	–	–	–	–	–	–	–	–	–	–	1
	1890, .	–	–	–	–	–	–	–	–	–	–	–	1	1
	1891, .	2	2	2	1	2	1	–	–	–	–	–	–	10
	1892, .	2	2	2	1	–	–	–	–	–	–	1	1	9
	1893, .	1	1	–	1	1	–	–	–	–	2	1	–	7
	1894, .	–	1	–	–	–	–	–	–	–	–	–	–	1
	1895, .	–	–	–	1	–	–	–	–	–	–	–	1	2
Totals for the Months, ...		6	6	4	4	3	1	–	–	–	2	2	3	31

Three Outer Stations.	Years.	Months.												Total for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	1	2	–	–	–	–	–	–	–	–	–	–	3
	1890, .	–	–	–	1	–	–	–	–	–	–	1	2	4
	1891, .	–	2	2	1	1	–	–	–	–	–	2	2	10
	1892, .	1	1	2	2	–	–	–	–	–	2	1	1	10
	1893, .	–	1	–	–	–	1	–	–	–	2	–	2	6
	1894, .	–	2	–	–	–	–	–	–	–	–	–	–	2
	1895, .	–	–	–	1	–	–	–	–	–	–	–	–	1
Totals for the Months, ...		2	8	4	5	1	1	–	–	–	4	4	7	36

TABLE VI.—*continued.*

Outer Stations—*continued.*	Years.	Months.												Total for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
VIII.	1889, .	1	–	–	–	–	–	–	–	–	–	–	–	1
	1890, .	–	–	–	2	1	–	–	1	–	–	–	2	6
	1891, .	–	2	–	–	–	1	–	–	–	–	2	–	5
	1892, .	2	2	2	–	1	1	–	–	–	1	–	2	11
	1893, .	1	–	–	1	1	–	–	–	–	1	–	2	6
	1894, .	1	1	–	1	–	–	–	–	–	–	–	–	3
	1895, .	–	1	–	1	–	–	–	–	–	–	–	2	4
Totals for the Months, ...		5	6	2	5	3	2	–	1	–	2	2	8	36
IX.	1889, .	1	–	–	–	–	–	–	–	–	–	1	–	2
	1890, .	–	–	–	1	–	–	–	1	–	–	–	–	2
	1891, .	–	2	–	1	1	–	–	–	–	–	1	–	5
	1892, .	2	2	2	1	1	–	1	–	–	1	–	2	12
	1893, .	–	–	–	1	–	–	–	–	–	2	–	2	5
	1894, .	–	1	–	–	–	–	–	–	–	–	–	–	1
	1895, .	–	1	–	–	–	–	–	–	–	–	–	1	2
Totals for the Months, ...		3	6	2	4	2	–	1	1	–	3	2	5	29

The Table shows that the total number of records for Stations I., III., V., and VIII. is nearly the same; and it is of interest to note that Stations IV. and IX., which are also nearly equal but show a smaller number of records than the others, might have been expected to have yielded very different results, as the first is an inshore station, while the other is the farthest seaward of all the Forth stations, being situated considerably east of the May Island. Another point of interest is, that besides the comparative absence of these Amphipods during the summer months there is evidence of a somewhat remarkable increase of those Crustaceans in the Forth in 1891 and 1892 compared with other years. With reference to the remarkable increase in the number of *Parathemisto* in the Forth during these two years, it is specially worthy of note that in February 1892 an immense shoal of *Euthemisto compressa*—a species closely allied to *Parathemisto* in structure and habits—was observed off the Yorkshire coast. So great in number were they that the sea was described as "literally alive with them," and it is stated that "heaps" of them "were afterwards washed ashore by sea-winds, and afforded a feast for starlings and other frequenters of the tidal line." * Some of these *Euthemisto* found their way into the Forth estuary, and are mentioned among the tow-net records for that year. They were first observed in the Forth in February, and they either remained in the estuary all the summer or returned in the autumn, for they were observed again in November.

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* T. H. Nelson in 'Naturalist' for May 1892.

Whether this irruption of the Hyperiidæ was merely accidental and temporary, or due to a periodic migration at more or less distant intervals of time, the records are not sufficiently extensive to show. Whatever be the reason, there seems to be no doubt that some time during 1891 and 1892 there was a greater number than usual of these Crustaceans off our East Coast, part of which found their way inshore, with the result that the number of records of *Parathemisto* was increased beyond those of the previous or following years.

In the following analysis of the Table, some of the results referred to are more clearly brought out—the three formulæ subjoined show the total numbers of the records (1) for the stations, (2) the months, and (3) the years, thus :—

Formula (1) shows the total number of the records of *Parathemisto* for each of the stations for all the months and years :—

Numbers of the Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, -	37	39	31	36	36	29

Formula (2) shows the total number of the records of *Parathemisto* for each of the months for all the years, (*a*) for Stations I., III., and IV. ; (*b*) for Stations V., VIII., and IX. ; and (*c*) for all the six stations : -

Names of the Months, - - - - -		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations, -	16	18	10	15	7	3	0	5	0	7	11	15
	(*b*) the Outer Stations, -	10	20	8	14	6	3	1	2	0	9	8	20
	(*c*) all the Six Stations, -	26	38	18	29	13	6	1	7	0	16	19	35

Formula (3) shows the total number of the records of *Parathemisto* for each year, for (*a*) the inner stations, I., III., and IV. ; (*b*) the outer stations, V., VIII., and IX. ; and (*c*) for all the six stations :—

Numbers of Years, - - - -		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations, -	2	4	34	27	17	14	9
	(*b*) the Outer Stations, -	6	12	20	33	17	6	7
	(*c*) all the Six Stations, -	8	16	54	60	34	20	16

Euthemisto compressa. This species (referred to above) was recorded for the first time in the Firth of Forth in the "Tenth Annual Report of the Fishery Board for Scotland," from specimens obtained at Station V. in February 1892. It was collected again in the same year in November; and the next record of it is in November 1893, when it was obtained at Station V.

The other Amphipods mentioned in the list are, with the exception of *Paratylus* and *Apherusa*, only occasionally referred to among the records of tow-net invertebrates, and are therefore, except from a natural history point of view, of less importance than those already mentioned. Consequently I do not propose to enter very minutely into the consideration of their distribution.*

Callisoma crenata. There are few records of this species, and they extend from 1890 to 1895.

Hippomedon denticulatus is only recorded once among the tow-net lists for the selected stations—viz., for Station IX. in February 1894.

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* A tabulated list of species at the end of this paper shows some further details of the distribution of these Amphipods.

Bathyporeia and *Ampelisca* have been recorded, but the species were apparently not identified.

Stenothoë marina has one or two records, but it appears to have been comparatively rare in the tow-net gatherings under consideration.

Argissa hamatipes is occasionally recorded in the lists of tow-net invertebrates collected at the three outer stations, but less frequent in those collected at the inner stations.

Metopa alderi appears to have been comparatively frequent at nearly all the stations.

Periocidodes longimanus is recorded chiefly from the outer stations.

Iphimedia obesa is only recorded once—in 1892 for Station V. in January.

Apherusa (two species) and *Paratylus* are referred to several times in the lists of tow-net invertebrates; neither of them appears to be rare, though less common than some of the others.

Melphidippella macera is only once recorded—viz., at Station VIII. in March 1892.

Amathilla homari is also recorded once—viz., for Station IV. in December 1892.

Gammaropsis erythrophthalmus is recorded once—for Station V. in December 1890.

Dulichia sp. and *Pariambus typicus* are both rarely mentioned among the lists of tow-net gatherings.

(*f*) Cladocera.

Evadne nordmanni is recorded from nearly all the six stations, and was occasionally moderately frequent.

Podon (?) *polyphemoides*, though not so common as *Evadne*, is recorded several times, and for at least four different stations.

(*g*) Copepoda.

The Copepoda, though usually present in nearly all the tow-net gatherings, being sometimes common or even abundant, do not usually show much variety of species. The following is a list of the Copepods recorded in the various tow-net gatherings collected during the seven years at the six selected stations:—

Calanus finmarchicus (Gunner).
Pseudocalanus elongatus, Boeck.
Temora longicornis (Müller).
Centropages hamata, Lillj.
Centropages typicus, Kr.
Metridia hibernica (B. & R.).
Candace pectinata, Brady.
Acartia sp. (? *Clausii* and *longiremis*).
Anomalocera patersoni, Templ.
Parapontella brevicornis (Lub.).
Oithona (?) *similis*, Claus.
Thalestris longimanus, Claus.
Thalestris serrulatus, Brady.
Alteutha depressa (Baird).
Dermatomyzon nigripes (B. and R.).
Monstrilla sp.
Caligus rapax, Müller

A few of the species named above are found occurring with more or less frequency in nearly all the lists of tow-net invertebrates, but the larger number of them were infrequent or rare, and it is those only that are of numerical importance that need be specially referred to here. The first of them that I propose to notice is *Calanus finmarchicus. Calanus finmarchicus* is, because of its numbers and its general distribution, one of the most important of the group to which it belongs, at least in the British seas. Being usually so numerous, it no doubt furnishes a rich supply of food to the young of all kinds of fishes, and, as a matter of fact, it frequently forms the principal food of the herring. This species is, as a rule, usually more numerous than the other pelagic Copepods, and it occurs at times in considerable abundance in the estuary. Its distribution, as indicated by the tow-net records, is as follows:—In 1889 *Calanus* is recorded twice for Station I. in January; once in July, August, October, and November for Station III.; once in January, July, and August for Station IV.; once in January, May, June, August, and September for Station V., while for the same station in November *Calanus* is recorded as abundant in the surface and frequent in the bottom tow-nets; for Station VIII. it is recorded once in January, twice in June and July, once in August, and once in November; for Station IX. there are two records in June, one in August, and two in November. In the surface tow-net record for November *Calanus* is described as abundant, and as common in the bottom tow-net.

In 1890 the records of *Calanus* for Station I. are two in February, March, April, May, July, October, and November, and one in December. It is described as abundant in one and common in four of these gatherings. The records for Station III. are two in February, March, April, May, July, October, and November, and one in August; for Station IV. there are two records in March, May, November, and December, and one in February, April, July, August, and October. The records for Station V. are two in February, March, April, May, September, October, November, and December, and one in July. For Station VIII. there are two records in March, April, May, September, and December, and one in February, July, and October; while for Station IX. there are two records in March, April, May, October, and December, and one in February, July, and September. The records for *Calanus* in 1891 are for Station I. two in February, March, April, May, June, and August, and one in January, July, October, and November. For Station III. there are two records in February, April, May, June, July, and December, and one in January, August, September, October, and November. For Station IV. there are two records in January, February, March, April, May, June, and October, and one in August and November. The records for Station V. are two in February, March, April, May, July, October, November, and December, and one in June and August. Station V. having been trawled twice in October adds a third record for that month. There are two records for Station VIII. in February, April, May, June, and November, and one in July, August, September, and October; while for Station IX. there are two records in February, May, June, July, August, and November, and one in April, September, and October—making ninety-seven records in all for 1891. The number of the records of *Calanus* for 1892 is about equal to that of the previous year. Those for Station I. are two in April, May and December, and one in January, February, March, July, September, and November. For Station III. there are two records in February, March, April, May, November, and December, and one in January, July, September, and October. The records for Station IV. are two in March, April, May, June, October, and December, and one in January, February, July, September, and November. For Station V. there are two records in January, April, May, October, November, and December, and one in March, July, and September. The records for Station VIII. are two in March, April, and September, and one in January, February, May, June, July, and November. In December this station was trawled twice, and furnished four records of *Calanus* for that month. The records for Station IX. are two in January, February, April, May, September, and October, and one in March, June, and July. There are also three records in December, the station having been trawled twice that month.

The records for 1893 are as follows:—For Station I. there are two in January, April, May, September, and November, and one in February, June, July, August, October, and December. For Station III. there are two in January and December, and one in February, May, June, July, August, September, October, and November. For Station IV. there are two in January, February, April, June, October, and November, and one in May and December. There are for Station V. two records in February, May, August, October, and December, and one in March, June, July, September, and November. There are two records for Station VIII. in January, April, July, and December, and one in February, May, August, September, and October, while for Station IX. there are two records in January, February, May, June, July, October, and December, and one in April and August.

The records of *Calanus* for 1894, which are fewer than for the three preceding years, include two for Station I. in April and December, and one in January and February. There are two for Station III. in August, and one in February, April, and June, while in December there are four records owing to the station having been twice trawled that month. For Station IV. there are two records in April and one in January and February. The records for Station V. are two in February and April and one in August. For Station VIII. there are two records in February and one in January, April, and August, and those for Station IX. are two in February and April. The records for this year number thirty-four.

The records of *Calanus* for 1895, which are also few in number, include two for Station I. in April and December, and one in February, May, and October. There are two for Station III. in February, April, October, and December, and one in May. There are two for Station IV. in February, October, and December, and one in January, April, and May. The records for Station V. are two in February, April, May, and August, two for Station VIII. in February, May, October, and December, and one in April and September, while for Station IX. there are two records in February, April, and December, and one in May, August, and September. The number of records for 1895 is fifty, while the total number for the seven years is four hundred and eighty-four.

The distribution of *Calanus finmarchicus*, as described in the preceding notes and shown by the annexed tabular arrangement of the number of records, is more uniform throughout the six stations than that of *Parathemisto*. It may be observed that there is a tendency towards an increase in the number of records during the earlier months, and also to a small extent during the later months of the year, but this tendency shows itself principally in the greater number of double records for these months: that is, records which include both the bottom and surface tow-net gatherings. This is shown more clearly by the Table.

Table VII., giving the Distribution of *Calanus finmarchicus,* as shown by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Number of Records for each Month of each Year.												Totals for Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	2	–	–	–	–	–	1	1	–	1	1	–	6
	1890, .	–	2	2	2	2	–	2	–	–	2	2	1	15
	1891, .	1	2	2	2	2	2	1	2	–	1	1	–	16
	1892, .	1	1	1	2	2	–	1	–	1	–	1	2	12
	1893, .	2	1	–	2	2	1	1	1	2	1	2	1	16
	1894, .	1	1	–	2	–	–	–	–	–	–	–	2	6
	1895, .	–	1	–	2	1	–	–	–	–	1	–	2	7
Total Records for the Months, .		7	8	5	12	9	3	6	4	3	6	7	8	78
III.	1889, .	1	–	–	–	–	1	1	1	–	–	1	–	5
	1890, .	–	2	2	2	2	–	2	1	–	2	2	–	15
	1891, .	1	2	–	2	2	2	2	1	1	1	1	2	17
	1892, .	1	2	2	2	2	–	1	–	1	1	2	2	16
	1893, .	2	1	–	–	1	1	1	1	1	1	1	2	12
	1894, .	–	1	–	2	–	1	–	2	–	–	–	4	10
	1895, .	–	2	–	2	1	–	–	–	–	2	–	2	9
Total Records for the Months, .		5	10	4	10	8	5	7	6	3	7	7	12	84
IV.	1889, .	1	–	–	–	–	–	1	1	–	–	1	–	4
	1890, .	–	1	2	1	2	–	1	1	–	1	2	2	13
	1891, .	2	2	2	2	2	2	–	1	–	2	1	–	16
	1892, .	1	1	2	2	2	2	1	–	1	2	1	2	17
	1893, .	2	2	–	2	1	2	–	–	–	2	2	1	14
	1894, .	1	1	–	2	–	–	–	–	–	–	–	–	4
	1895, .	1	2	–	1	1	–	–	1	–	2	–	2	10
Total Records for the Months, .		8	9	6	10	8	6	3	4	1	9	7	7	78

[Table.

TABLE VII.—*continued.*

Three Outer Stations.	Years.	Number of Records for each Month of each Year.												Totals for Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	1	–	–	–	1	1	–	1	1	–	2	–	7
	1890, .	–	2	2	2	2	–	1	–	2	2	2	2	17
	1891, .	–	2	2	2	2	1	2	1	–	3	2	2	19
	1892, .	2	–	1	2	2	–	1	–	1	2	2	2	15
	1893, .	–	2	1	–	2	1	1	2	1	2	1	2	15
	1894, .	–	2	–	2	–	–	–	1	–	–	–	–	5
	1895, .	–	2	–	2	2	–	–	2	–	–	–	–	8
Totals for the Months, . . .		3	10	6	10	11	3	5	7	5	9	9	8	86
VIII.	1889, .	1	–	–	–	–	2	2	1	–	–	1	–	7
	1890, .	–	1	2	2	2	–	1	–	2	1	–	2	13
	1891, .	–	2	–	2	2	2	1	1	1	1	2	–	14
	1892, .	1	1	2	2	1	1	1	–	2	1	–	4	16
	1893, .	2	1	–	2	1	–	2	1	1	1	–	2	13
	1894, .	1	2	–	1	–	–	–	1	–	–	–	–	5
	1895, .	–	2	–	1	2	–	–	–	1	2	–	2	10
Totals for the Months, . . .		5	9	4	10	8	5	7	4	7	6	3	10	78
IX.	1889, .	–	–	–	–	–	2	–	1	–	–	2	–	5
	1890, .	–	1	2	2	2	–	1	–	1	2	–	2	13
	1891, .	–	2	–	1	2	2	2	2	1	1	2	–	15
	1892, .	2	2	1	2	2	1	1	–	2	2	–	3	18
	1893, .	2	2	–	1	2	2	2	1	–	2	–	2	16
	1894, .	–	2	–	2	–	–	–	–	–	–	–	–	4
	1895, .	–	2	–	2	1	–	–	1	1	–	–	2	9
Totals for the Months, . . .		4	11	3	10	9	7	6	5	5	7	4	9	80

This Table also shows that the difference in the total number of records for each of the stations for the seven years is comparatively small. The highest number (86) is for Station V., while the lowest numbers occur at Stations I., IV., and VIII.—each of these stations having a total of 78 records for the seven years. The number of records for each of the stations may be stated as a formula, thus :—

Formula (1) shows the total number of records of *Calanus* for each station for all the seven years :—

	Inner Stations.			Outer Stations.		
Numbers of the Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, -	78	84	78	86	78	80

The total numbers of the monthly records exhibit a greater amount of divergence than those for the stations as shown by the next formula.

Formula (2) shows the total number of records of *Calanus* for each of the stations for the seven years, (*a*) for the inner stations, I., III., and IV.; (*b*) for the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Names of the Months, - - - - - - -		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations, - -	20	27	15	32	25	14	16	14	7	22	21	27
	(*b*) the Outer Stations, - -	12	30	13	30	28	15	18	16	17	22	16	27
	(*c*) all the Six Stations, - -	32	57	28	62	53	29	34	30	24	44	37	54

Yet although there is a certain amount of variation, with the exception of one or two months—as March and September—this variation is comparatively trifling, showing that *Calanus* was not only common, but also, on an average, very equally distributed throughout the estuary. The total number of records of this Copepod for the three inner and three outer stations, for the twelve months and for all the seven years, is 240 and 244 respectively, or practically the same for the two groups of stations. Another point which may be noticed here, and which is shown in the Table, is that the totals of the monthly records for the seven years and for each of the six stations for April are, with one exception, exactly alike—the number for April for each station being ten, except at Station I., where the number is twelve. It would also appear from the tabular enumeration of the records that during six out of the seven years (excluding 1889) *Calanus* was more common and generally diffused throughout the district referred to here, in the month of April, than in any of the other months. The reason for this uniformity may not be easily explained. It may be due to a periodic migration of *Calanus*, or to some influence inducing them to crowd more in towards the shore at this season—probably for spawning.

Formula (3) shows the total number of records of *Calanus* for each of the seven years, (*a*) for the inner stations, I., III., and IV.; (*b*) for the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Numbers of the Years, - - - -		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations,	15	43	49	45	42	20	26
	(*b*) the Outer Stations,	19	43	48	49	44	14	27
	(*c*) all the Six Stations,	34	86	97	94	86	34	53

The greatest difference between the yearly totals for the inner and outer stations is that for 1894, while the total number for the seven years for each group of stations shows only a difference of four—the numbers being for the inner stations 240 and for the outer stations 244.

But though *Calanus finmarchicus* is the most common Copepod in the Firth of Forth, there are one or two other species included in the lists of tow-net gatherings which are more or less generally distributed, and at times moderately frequent, and which no doubt compete closely with *Calanus* as important sources of fish-food, especially as the food of young fishes. *Temora longicornis* is one of these; so also, though in a somewhat less degree, are one or two species of *Acartia*—viz., *A. longiremis* and *A. clausii* (both of which are found in the Forth estuary). I do not propose to refer at length to the distribution of these Copepods, as the Tables which follow show by comparison with that of *Calanus* its more important details, as well as some other of the more noticeable differences in this respect between them and that species.

TABLE VIII., showing the Distribution of *Temora longicornis*, as indicated by the Tow-net Records for the Years, Months, and Stations

Three Inner Stations.	Years.	Number of Records for each Month of each Year.												Totals for Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	–	–	–	–	–	–	–	1	–	1	1	–	3
	1890, .	–	–	1	2	2	–	1	–	–	2	2	–	10
	1891, .	–	1	1	2	2	2	1	2	–	–	–	–	11
	1892, .	–	–	–	2	2	2	1	–	1	–	–	–	8
	1893, .	–	–	–	2	2	1	–	–	–	–	–	–	5
	1894, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1895, .	–	–	–	1	2	–	–	–	1	1	–	–	5
Totals for the Months,	. .	–	1	2	10	10	5	3	3	2	4	3	–	43
III.	1889, .	–	–	–	–	–	1	1	1	–	–	–	–	3
	1890, .	–	–	–	2	1	–	1	–	–	1	2	–	7
	1891, .	–	1	–	2	2	2	1	–	–	–	–	–	8
	1892, .	–	–	–	2	2	2	–	–	1	1	–	–	8
	1893, .	–	1	–	–	1	2	1	1	–	1	–	1	8
	1894, .	–	–	–	2	–	1	–	–	–	–	–	1	4
	1895, .	–	1	–	2	2	–	–	–	–	1	–	–	6
Totals for the Months,	. .	–	3	–	10	8	8	4	2	1	4	2	2	44
IV.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	–	–	1	2	–	–	–	–	–	2	1	6
	1891, .	–	1	2	2	2	–	–	2	–	–	–	–	9
	1892, .	–	–	–	2	2	1	–	–	1	2	1	–	9
	1893, .	–	–	–	–	2	1	–	–	–	–	–	1	4
	1894, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1895, .	1	1	–	1	2	–	–	1	–	2	–	–	8
Totals for the Months,	. .	1	2	2	7	10	2	–	3	1	4	4	2	38

[TABLE.

TABLE VIII.—*continued.*

Three Outer Stations.	Years.	Number of Records for each Month of each Year.												Totals for Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	–	–	–	–	1	1	–	2	–	–	1	–	5
	1890, .	–	2	2	2	2	–	1	–	2	2	2	–	15
	1891, .	–	–	2	2	2	–	1	2	–	–	–	–	9
	1892, .	–	–	–	1	2	2	–	–	1	2	–	–	8
	1893, .	–	–	–	–	2	1	1	2	1	–	1	–	8
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	–	–	–	1	2	–	–	–	–	–	–	–	3
Totals for the Months, .	.	–	2	4	6	11	4	3	7	4	4	4	–	49
VIII.	1889, .	–	–	–	–	–	1	–	1	–	–	1	–	3
	1890, .	–	–	2	2	2	–	1	–	2	1	–	1	11
	1891, .	–	1	–	2	2	1	1	2	2	–	–	–	11
	1892, .	–	–	–	2	2	2	–	–	1	1	–	–	8
	1893, .	–	–	–	1	1	1	1	1	1	–	–	–	6
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	–	–	–	1	1	–	–	–	1	–	–	–	3
Totals for the Months, .	.	–	1	2	8	8	5	3	5	7	2	1	1	43
IX.	1889, .	–	–	–	–	–	–	2	2	–	–	1	–	5
	1890, .	–	–	2	2	1	–	2	–	1	2	–	–	10
	1891, .	–	1	–	2	2	1	–	2	2	1	–	–	11
	1892, .	–	–	–	1	2	2	–	–	1	1	–	1	8
	1893, .	–	–	–	–	1	1	–	1	–	–	–	–	3
	1894, .	–	–	–	1	–	–	–	2	–	–	–	–	3
	1895, .	–	–	–	1	1	–	–	–	1	–	–	–	3
Totals for the Months, .	.	–	1	2	7	7	4	4	7	5	4	1	1	43

This Table contains an enumeration of the number of records of *Temora* for all the stations and for the seven years, arranged in the same way as those of *Calanus*. An examination of the Table shows that the distribution of *Temora* differs little from that of *Calanus*, except that the number of records is rather fewer. Like *Calanus*, the highest number of yearly records of *Temora* occur in 1891, 1892, and 1893; and also, like that species, there is with one exception comparatively little difference in the total number of records for each of the stations: the principal difference is found at Station V., where the number is greater, by five records, than the highest number next to it, at Station III., while it is eleven records greater than the minimum number at Station IV. It may also be noted that the station with the highest number of records of *Temora* and *Calanus* is the same—viz., Station V. But the Table shows a slight diversity in the distribution of *Temora* throughout the different months of the year as compared with that of *Calanus*. Thus, the maxima of monthly records are found in April and May, that for May being distinctly higher than that for April, and the minima in January, February, March, and December; while in regard to *Calanus* the maximum number is that for April, while the number for February is smaller than the maximum by only five records. These points are more clearly indicated in the annexed formulæ.

Formula (1) shows the total number of records of *Temora* for each station for all the seven years:—

	(*a*) Inner Stations.			(*b*) Outer Stations.		
Numbers of the Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, -	43	44	38	49	43	43

Formula (2) shows the total number of records of *Temora* for each of the twelve months, (*a*) for the inner stations, (*b*) for the outer stations, and (*c*) for all the six stations:—

Names of the Months, - - - - - - -		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations, - -	1	6	4	27	28	15	7	8	4	12	9	4
	(*b*) the Outer Stations, - -	0	4	8	21	26	13	10	19	16	10	6	2
	(*c*) all the Six Stations, - -	1	10	12	48	54	28	17	27	20	22	15	6

In the distribution of *Calanus* the month that shows the smallest number of records is September, but in the case of *Temora* the smallest number is that for January, and the proportional difference between the lowest and highest number of records is considerably greater for *Temora* than for *Calanus*.

Formula (3) shows the total number of records of *Temora* for each of the seven years, (*a*) for the inner stations, I., III., and IV.; (*b*) for the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Numbers of the Years, - - - -		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations, -	7	23	28	25	17	6	19
	(*b*) the Outer Stations, -	13	36	31	24	17	5	9
	(*c*) all the Six Stations, -	20	59	59	49	34	11	28

There seems to be a greater variation in the total numbers for the years in the distribution of *Temora* than is the case with *Calanus*. The above formula shows that in the case of *Temora* the highest total number of yearly records is fully five times greater than the lowest, but in *Calanus* the difference is less than three times; and further, the yearly maxima for *Temora* occur in 1890 and 1891, and in 1891 and 1892 for *Calanus*. The total number of records for *Temora* for the six stations during the seven years is two hundred and sixty.

ACARTIA SP.

The next Table shows the distribution of *Acartia* sp.,* in a manner similar to that of *Calanus* and *Temora*.

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* Careful examination is necessary in order to distinguish the species of *Acartia*, and for various reasons it was not always possible to carry out a minute and sufficiently careful examination of doubtful species on board ship; therefore the specimens of *Acartia* observed were frequently recorded merely under their generic name.

TABLE IX., showing the Distribution of *Acartia* sp., as indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	–	–	–	–	–	1	1	–	–	1	–	3
	1891, .	–	2	1	1	2	1	–	1	–	–	–	–	8
	1892, .	–	1	–	1	–	–	1	–	2	–	–	–	5
	1893, .	–	1	–	1	1	1	–	–	–	–	–	–	4
	1894, .	–	–	–	–	–	–	–	1	–	–	–	1	2
	1895, .	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals for the Months, . .		–	4	1	3	3	2	2	3	2	–	2	1	23
III.	1889, .	–	–	–	–	–	1	–	1	–	–	–	–	2
	1890, .	–	–	–	–	–	–	1	1	–	1	–	–	3
	1891, .	–	2	–	1	1	2	–	1	–	–	1	–	8
	1892, .	–	–	–	1	–	–	1	–	1	–	2	–	5
	1893, .	–	2	–	–	–	2	–	–	–	–	–	–	4
	1894, .	–	–	–	–	–	1	–	1	–	–	–	–	2
	1895, .	–	–	–	1	1	–	–	–	–	–	–	–	2
Totals for the Months, . .		–	4	–	3	2	6	2	4	1	1	3	–	26
IV.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	–	–	–	1	–	–	1	–	1	1	–	4
	1891, .	–	1	1	2	–	1	–	1	–	2	–	–	8
	1892, .	–	–	–	–	2	–	1	–	1	2	–	–	6
	1893, .	–	–	–	2	2	2	–	–	–	–	–	–	6
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	–	–	–	1	1	–	–	–	–	–	–	–	2
Totals for the Months, . .		–	1	1	5	6	3	1	3	1	5	2	–	28

[TABLE.

TABLE IX.—*continued.*

Three Outer Stations.	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	–	–	1	–	–	1	–	1	1	1	–	5
	1891, .	–	1	1	1	2	1	–	1	1	1	–	–	9
	1892, .	–	–	–	–	1	1	1	–	–	1	–	–	4
	1893, .	–	–	–	–	1	–	–	2	–	–	–	–	3
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	–	–	–	–	1	–	–	1	–	–	–	–	2
Totals for the Months, . .		–	1	1	2	5	2	2	5	2	3	2	–	25
VIII.	1889, .	–	–	–	–	–	–	–	–	–	–	1	–	1
	1890, .	–	–	1	–	1	–	–	–	1	1	–	–	4
	1891, .	–	2	–	1	1	1	–	2	1	–	1	–	9
	1892, .	–	–	–	–	1	1	1	–	–	1	–	–	4
	1893, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	–	–	–	1	1	–	–	1	–	–	–	–	3
Totals for the Months, . .		–	2	1	2	4	2	1	5	2	2	2	–	23
IX.	1889, .	–	–	–	–	–	–	–	1	–	–	1	–	2
	1890, .	–	–	–	1	–	–	1	–	1	–	–	1	4
	1891, .	–	2	–	2	1	–	–	2	–	–	–	–	7
	1892, .	–	–	–	–	2	1	1	–	–	1	–	–	5
	1893, .	–	–	–	–	1	–	–	–	–	–	–	–	1
	1894, .	–	–	–	–	–	–	–	2	–	–	–	–	2
	1895, .	–	–	–	–	–	–	–	–	–	–	–	–	–
Totals for the Months, . .		–	2	–	3	4	1	2	5	1	1	1	1	21

It will be observed from this Table that the distribution of *Acartia* varies to a greater extent from that of *Calanus* than that of *Temora* was found to do. The greatest number of yearly records of *Acartia* shown in the Table is that for 1891, and not only is the yearly total number for the six stations for 1891 the greatest, but the same thing is observed in the total number of each of the stations for that year. If, on the other hand, a comparison be made between the highest and lowest total numbers for the six stations, the difference is rather less than in *Temora*, and more similar to that observed in *Calanus*. It is also noticeable that *Acartiæ* are comparatively usually more frequent during the summer months. It will be observed, for example, that the highest of the total monthly records for each of the three outer stations are those for May and August; while at Station IV. the highest is that for May, and at Station III. for June; but at Station I. the highest is that for February. The next highest numbers are those for April, May, and August. Some of these points are more clearly indicated by the three formulæ.

Formula (1) shows, as before, the total number of records of *Acartia* for each of the stations :—

	(*a*) Inner Stations.			(*b*) Outer Stations.		
Numbers of the Stations, - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station,	23	26	28	25	23	21

The station with the lowest number is IX., while that with the highest number is IV., the difference between them being seven.

Formula (2) shows the total number of records of *Acartia* for each of the twelve months for the seven years, (*a*) for the inner stations, I., III., and IV.; (*b*) for the outer stations, V., VIII., and IX.; (*c*) for all the six stations :—

Names of the Months, - - - - - -		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations, -	0	9	2	11	11	11	5	10	4	6	7	1
	(*b*) the Outer Stations, -	0	5	2	7	13	5	5	15	5	6	5	1
	(*c*) all the Six Stations, -	0	14	4	18	24	16	10	25	9	12	12	2

If these figures be closely examined and compared, it will be found that there is a more or less evident maximum in the total number of records about every three months. This is also found to be the case, though not so distinctly, when the numbers are divided so as to correspond with the inner and outer stations. But taking the total numbers first, it will be observed that, commencing with February, the total number for which is fourteen, there occurs in March a sudden drop, after which the numbers increase till May, when the second highest total for the whole year is reached. In June and July the numbers again fall, to be followed by a marked accession in August, so much so that the maximum for all the twelve months occurs then; in September there is again a marked decrease, after which a slight recovery takes place in October and November, while in December the number is, next to January, the lowest for the year. This increase and decrease, though not so apparent where the numbers are divided to correspond with the inner and outer stations, can still be traced, especially in the series corresponding to the outer stations. The reason for this apparent rhythmical arrangement is not very clear, and it may be that the seemingly periodic recurrence of *Acartia* may be merely accidental.

Formula (3) shows the total number of records of *Acartia* for each year, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) all the six stations :—

Numbers of the Years, - - - - -		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year.	(*a*) the Inner Stations, -	4	10	24	16	14	5	4
	(*b*) the Outer Stations, -	4	13	25	13	5	4	5
	(*c*) all the Six Stations, -	8	23	49	29	19	9	9

It will be observed that the maximum number—that for 1891—is proportionally considerably greater in comparison with the others than is observed either in the case of *Calanus* or *Temora*.

A few of the other species of Copepoda referred to in the lists of townet invertebrates, such as *Pseudocalanus elongatus*, *Centropagus* sp., *Anomalocera patersoni*, and *Oithona* sp., are also at times more or less frequent in the Firth of Forth, but the published records of them show that they are usually less common than those already noticed.

The only points of interest in connection with the distribution of *Pseudocalanus elongatus*, so far as can be made out from the tow-net records of its occurrence, seem to be these—(1st) if an average of all the records of this Copepod for the seven years be taken, the numbers for April and May will be seen to be greater than those for all the other months added together; and (2nd) that the maxima of the records for the seven years occur in 1891, 1892, and 1893.

Anomalocera patersoni, which from its very large size and beautiful colour is easily detected among the tow-net gatherings, is recorded a considerable number of times during the seven years. The greatest total number of records for any of the years is that for 1891, the number for that year being nearly double that for any other of the whole seven, as shown by the formula.

Formula (1) shows the number of records of *Anomalocera* for each of the seven years :—

Numbers of the Years, - - - - -	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year,	7	13	17	6	9	4	6

This formula shows a gradual increase to the maximum, then a somewhat irregular decrease.

Formula (2) shows the total number of records of *Anomalocera* for each of the twelve months :—

Names of the Months,	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Number of Records for each Month,	0	0	0	3	20	18	8	7	1	4	0	1

It will be observed that by far the largest number of records for this species occur in May and June; they are much fewer in July, August, and October, and rarely, or none at all, in the other months. It would appear from this that *Anomalocera* is not resident in the estuary, but is only a summer visitor, and, as Formula (1) shows, its visits are fairly regular.

Formula (3) shows the total number of records of *Anomalocera* for each of the six stations :—

	Inner Stations.			Outer Stations.		
Numbers of the Stations, - - - -	I.	III.	IV.	V.	VIII.	IX.
Number of Records for each Station, -	5	5	1	15	16	19

The difference between the inner and the outer stations is very marked here, but is only what might be looked for if *Anomalocera* be only a "visitor" to the estuary and its vicinity. This also explains why Station IV. appears to have been so rarely visited, for, being a migrant, *Anomalocera* is more likely to keep as much as possible to the open water, and avoid inshore localities.

The distribution of the other species mentioned in the lists of tow-net fauna does not call for special analysis; but a few of them are of interest because of their beauty, their rarity, or because of their structural differences and habits.

Metridia hibernica, which is of an elongate form, and has a long and moderately slender abdomen, is recorded only once during the seven years—viz., at Station IX. in May 1892, when a few specimens were obtained. *Metridia* is a comparatively large Copepod.

Candace pectinata is also moderately large, and is readily noticed by its dark chocolate-coloured swimming feet. There are several records of this species in the lists of tow-net invertebrates.

Parapontella brevicornis appears to be only once recorded for the seven years, but the species is not very rare locally.

Dermatomyzon nigripes is also only once mentioned in the tow-net lists for the selected stations.

Monstrilla sp. The most curious of the pelagic Copepods is the *Monstrilla.* Two species—*M. helgolandica* and *M. rigida*—have been captured in the estuary. In swimming it differs from the usual Copepod habit by keeping its antennules straight out in front, instead of holding them at right angles.

Oithona sp. The *Oithona* that is sometimes not uncommon in the Firth of Forth is probably the *O. similis* Claus, as stated by Dr. Giesbrecht.

Caligus rapax is frequently found "free-swimming" in the estuary, and appears to be able to adopt that mode of life at will.

(3.) The Vermes.

THE SAGITTA (*S. bipunctata*).

Leaving the Copepoda, I now pass on to consider the distribution of the *Sagitta.* A glance through the lists of pelagic invertebrates which form part of the trawling records shows that the *Sagitta* forms an item of considerable importance amongst the various objects collected by the tow-nets. Moreover, when the voracity of these curious organisms is taken into account, it is evident that the vast swarms of them that occasionally visit our shores must form a destructive agency of no mean order, and especially if in the vicinity of their swarms fish larvæ happen to be more or less common. It has been clearly proved that *Sagitta* prey to a considerable extent on larval and post-larval fishes—chiefly round fishes. This habit was observed by me several years ago, and before much attention had been given to it otherwise; and it was found that the *Sagitta* not only preyed on the larvæ of round fishes, but they also attacked the smaller Crustacea, and were even observed to devour their own kind—the larger *Sagitta* devouring the smaller.

The distribution of the *Sagitta* in the Firth of Forth during the seven years will be best seen by a reference to the annexed Table.

Table X., showing the Distribution of *Sagitta*, as indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	1	2	–	–	–	1	1	1	–	1	1	–	8
	1890, .	–	2	2	–	2	–	–	–	–	1	1	1	9
	1891, .	1	1	1	2	2	2	1	1	–	1	1	–	13
	1892, .	1	1	1	1	1	–	1	–	1	–	1	2	10
	1893, .	2	2	–	1	–	1	1	1	1	1	2	1	13
	1894, .	1	2	–	1	–	–	–	1	–	–	–	2	7
	1895, .	–	1	–	1	1	–	–	–	1	–	–	2	6
Totals for the Months, . . .		6	11	4	6	6	4	4	4	3	4	6	8	66

Table X.—*continued.*

Inner Stations—*continued.*	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
III.	1889, .	1	–	–	–	–	–	–	–	–	–	1	–	2
	1890, .	–	2		1	1	–	1	–	–	1	1	–	9
	1891, .	1	1	–	2	2	1	–	1	–	1	2	–	11
	1892, .	1	2	1	1	1	–	1	–	1	–	1	2	11
	1893, .	2	1	–	–	1	1	1	1	1	1	2	2	13
	1894, .	–	1	–	1	–	–	–	1	–	–	–	4	7
	1895, .	–	1	–	1	–	–	–	–	–	1	–	2	5
Totals for the Months, .	. .	5	8	3	6	5	2	3	3	2	4	7	10	58
IV.	1889, .	1	–	–	–	–	–	–	1	–	–	1	–	3
	1890, .	–	2	–	–	1	–	1	–	–	1	2	1	8
	1891, .	2	2	1	–	2	–	–	1	–	1	1	–	10
	1892, .	1	2	2	2	–	–	1	–	1	1	1	1	12
	1893, .	2	2	–	1	–	1	–	–	–	1	1	2	10
	1894, .	1	1	–	1	–	–	–	1	–	–	–	–	4
	1895, .	1	2	–	–	1	–	–	1	–	2	–	2	9
Totals for the Months, .	. .	8	11	3	4	4	1	2	4	1	6	6	6	56

Three Outer Stations.	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	2	2	–	–	1	1	–	2	–	–	1	–	9
	1890, .	–	1	–	2	1	–	2	–	–	1	2	2	11
	1891, .	–	–	1	1	1	1	1	1	2	2	2	2	14
	1892, .	1	1	2	1	1	1	1	–	1	1	2	2	14
	1893, .	2	1	–	–	1	1	2	2	1	2	1	2	15
	1894, .	–	2	–	1	–	1	–	1	–	–	–	–	5
	1895, .	–	2	–	1	2	–	–	1	–	–	–	–	6
Totals for the Months, .	. .	5	9	3	6	7	5	6	7	4	6	8	8	71

TABLE X.—*continued.*

Outer Stations—*continued.*	Years.	Number of Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
VIII.	1889, .	2	–	–	–	–	2	2	1	–	–	1	–	8
	1890, .	–	1	1	1	1	–	1	–	1	2	–	1	9
	1891, .	–	2	–	2	1	–	1	1	1	2	2	–	12
	1892, .	2	2	2	2	2	2	1	–	2	1	–	4	20
	1893, .	2	2	–	–	2	1	1	1	1	1	–	2	13
	1894, .	1	2	–	1	–	–	–	–	–	–	–	–	4
	1895, .	–	2	–	1	2	–	–	1	1	2	–	2	11
Totals for the Months, . . .		7	11	3	7	8	5	6	4	6	8	3	9	77
IX.	1889, .	2	–	–	–	–	2	1	1	–	–	1	–	7
	1890, .	–	1	2	1	2	–	2	–	2	1	–	2	13
	1891, .	–	2	–	2	1	2	1	1	1	2	2	–	14
	1892, .	2	1	2	1	1	1	1	–	1	1	–	3	14
	1893, .	2	2	–	–	2	1	2	1	–	2	–	2	14
	1894, .	–	2	–	–	–	1	–	1	–	–	–	–	4
	1895, .	–	2	–	1	–	–	–	2	1	–	–	2	8
Totals for the Months, . . .		6	10	4	5	6	7	7	6	5	6	3	9	74

This Table shows that the total number of records of *Sagitta* for the six selected stations, and for the seven years, is four hundred and five, being somewhat fewer than the number of records of *Calanus*, but considerably in excess of the number of records of any other of the species that have been referred to. In making an analysis of the Table, it is found that while there is a considerable difference between the number of records for Station IV. and that for Station VIII., if the three inner stations and the three outer stations be considered separately, the difference in the numbers of each group is much less. These points will be made more evident by arranging the stations and the number of records for each as a formula, thus :—

Formula (1) shows the number of records of *Sagitta* for each of the six selected stations :—

	The Three Inner Stations.			The Three Outer Stations.		
Numbers of Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Number of Records for each Station, -	66	58	56	74	77	74

The numbers for the three outer stations are nearly equal, but Station I. in the other three shows a greater divergence. It may also be noticed that Station I. and Station VIII., that have the highest number of records in each of the two groups, are intermediate stations—that is, Station I. is situated between Stations III. and IV., and Station VIII. between Stations V. and IX. Moreover, if a comparison be made of the total number of the records for each of the twelve months, it will be observed that those for February and December are considerably greater than the numbers for the other months; but if the numbers are separated into two groups to correspond with the inner and outer stations, the difference in the numbers for each of the twelve months for the three inner stations is increased, while the difference becomes less in the other group of numbers. This is best seen by arranging the numbers as a formula.

Formula (2) shows the total number of records of *Sagitta* for each of the twelve months, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Names of the Months,		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Three Inner Stations,	19	30	10	16	15	7	9	11	6	14	19	24
	(*b*) the Three Outer Stations,	18	30	10	18	21	17	19	17	15	20	17	26
	(*c*) all the Six Stations,	37	60	20	34	36	24	28	28	21	34	36	50

There is one point very clearly brought out in connection with the distribution of the *Sagitta*—viz., that, whether a comparison be made of the monthly numbers of records for each station or for the three inner and three outer stations or for them all, the numbers for February and most of those for December are greater than the others. This would seem to indicate that *Sagitta* was usually more common during these months than at other times of the year.

It will be further observed that the highest total number of yearly records, viz. 79, is that for 1892, and the smallest, 31, for 1894, and that if the yearly records be divided into two sets to correspond with the three inner and the three outer stations, the results, as regards the highest and lowest numbers, are somewhat different. In this arrangement of the figures the highest number for the three inner stations is that for 1893, and the lowest that for 1889, while the maximum and minimum numbers for the outer stations are for the same years as in the former arrangement. Formula (3) will show these results more clearly.

Formula (3) shows the total number of records of *Sagitta* for all the seven years; for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Numbers of the Years,		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations,	13	26	34	33	36	18	20
	(*b*) the Outer Stations,	24	33	40	48	42	13	25
	(*c*) all the Six Stations,	37	59	74	81	78	31	45

It would thus appear that *Sagitta,* like the majority of the other pelagic organisms of which there are records, are usually of more frequent occurrence in the Firth of Forth and its vicinity during the colder months, and that they were more numerous during 1891, 1892, and 1893 than during the other years. These again coincide with the yearly maxima for *Parathemisto*, and may be the result of a larger migration during these years, as was probably the case with *Parathemisto*, or to circumstances favouring a greater local increase; for though the difference in the number of the yearly records may be partly accounted for by the greater or fewer number of experiments, this does not explain the whole of it. Unfortunately the experiments were not carried on long enough nor so regularly as to indicate whether the difference shown is due to the actual increase or decrease of these organisms, and whether it was temporary and accidental or part of a more or less regular cycle of changes in their migration or development.

(4.) THE CŒLENTERATA.

THE CTENOPHORA AND HYDROMEDUSÆ.

The next groups of organisms that are numerically important and which may be specially noticed are the Ctenophora and Hydromedusæ. These include the well-known and beautiful *Pleurobrachia*, which sometimes occurs in such immense numbers that they seem to monopolise the whole of the water-space where they are. The swarms of these things that are sometimes met in with by the *Garland* are so great that the tow-nets, if unfortunately in use at the time, are found, when hauled on board, to be literally full of these crystal spheres, while little of anything else is found in the nets. The appearance of such a mass of *Pleurobrachia*—each globe, by the rapid movement of its delicate cilia, scintillating in the light—is wonderful, and cannot be accurately described. *Beroë* is another of the Cœlenterates that was sometimes met with in considerable numbers, but not usually in such immense swarms as *Pleurobrachia.* Various other forms, such as *Sarsia, Geryonopsis, Thaumantias,* &c., were also observed during the years referred to, but from want of time no attempt was made to differentiate the species, and they are therefore usually all included under the name of Ctenophora : on a few occasions only are *Pleurobrachiæ* and a few of the others specially mentioned. There are two hundred and ninety-six records of Ctenophora, including Hydromedusæ, among the lists of tow-net gatherings for the seven years, and their distribution for the months and stations is shown by the annexed Table :—

TABLE XI., showing the Distribution of the Ctenophora and Hydromedusæ, indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Number of the Records for each Month of each Year.												Totals for Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	2	2	–	–	–	1	2	2	–	–	1	–	10
	1890, .	–	–	1	1	–	–	2	2	–	2	1	–	9
	1891, .	1	1	–	–	1	1	–	–	–	2	2	–	8
	1892, .	1	2	1	–	–	2	1	–	–	1	1	2	11
	1893, .	2	1	–	1	1	1	1	2	2	2	1	–	14
	1894, .	–	2	–	–	–	–	–	2	–	–	–	2	6
	1895, .	–	1	–	–	–	–	1	–	–	1	–	1	4
Total number of Records for all the Months,		6	9	2	2	2	5	7	8	2	8	6	5	62
III.	1889, .	1	–	–	–	–	2	2	2	–	–	1	–	8
	1890, .	–	2	–	–	2	–	2	1	–	2	1	–	10
	1891, .	1	–	–	–	–	1	1	1	1	1	2	–	8
	1892, .	1	–	1	1	2	2	1	–	1	1	2	2	14
	1893, .	2	1	–	–	1	1	–	1	2	1	2	1	12
	1894, .	–	1	–	–	–	1	–	2	–	–	–	4	8
	1895, .	–	1	–	–	–	–	2	–	–	1	–	2	6
Total number of Records for all the Months,		5	5	1	1	5	7	8	7	4	6	8	9	66

TABLE XI.—*continued.*

Inner Stations—*continued.*	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
IV.	1889, .	1	–	–	–	–	2	2	2	–	–	1	–	8
	1890, .	–	1	–	1	2	–	–	1	–	2	2	1	10
	1891, .	1	1	–	–	–	1	–	1	–	1	–	–	5
	1892, .	2	1	–	–	–	1	2	–	–	–	1	2	9
	1893, .	2	1	–	–	1	–	–	2	2	2	2	1	13
	1894, .	–	–	–	–	–	–	–	1	–	–	–	–	1
	1895, .	1	–	–	–	–	–	–	2	–	2	–	2	7
Total number of Records for all the Months,		7	4	–	1	3	4	4	9	2	7	6	6	53

Three Outer Stations.	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	1	1	–	–	–	1	2	1	–	–	1	–	7
	1890, .	–	1	–	–	1	–	2	–	–	2	1	–	7
	1891, .	–	1	–	–	–	–	1	–	1	2	1	–	6
	1892, .	1	1	1	–	1	2	1	–	2	–	2	1	12
	1893, .	1	–	–	–	2	–	–	2	1	1	–	1	8
	1894, .	–	1	–	–	–	1	–	1	–	–	–	–	3
	1895, .	–	1	–	–	–	–	–	–	–	–	–	–	1
Total number of Records for all the Months,		3	6	1	–	4	4	6	4	4	5	5	2	44
VIII.	1889, .	1	–	–	–	–	–	2	2	–	–	1	–	6
	1890, .	–	–	–	–	1	–	–	1	–	–	–	–	2
	1891, .	–	–	–	–	–	–	–	–	–	2	–	–	2
	1892, .	1	–	1	–	–	2	1	–	2	1	–	2	10
	1893, .	1	1	–	–	1	1	1	1	1	–	–	–	7
	1894, .	–	1	–	–	–	2	–	–	–	–	–	–	3
	1895, .	–	–	–	–	1	–	–	1	–	1	–	1	4
Total number of Records for all the Months,		3	2	1	–	3	5	4	5	3	4	1	3	34

TABLE XI.—*continued.*

Outer Stations—*continued.*	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
IX.	1889, .	1	–	–	–	–	–	2	1	–	–	1	–	5
	1890, .	–	–	–	–	1	–	–	1	2	–	–	–	4
	1891, .	–	–	–	1	–	2	–	–	1	2	1	–	7
	1892, .	–	–	–	–	1	2	2	–	–	2	–	3	10
	1893, .	1	1	–	–	–	1	1	–	–	1	–	1	6
	1894, .	–	–	–	–	–	2	–	–	–	–	–	–	2
	1895, .	–	1	–	–	–	–	–	1	–	–	–	1	3
Total number of Records for all the Months,		2	2	–	1	2	7	5	3	3	5	2	5	37

In 1889 small Cœlenterates were abundant in a bottom tow-net gathering collected at Station IV. in July. In 1890 they were abundant in a surface tow-net gathering at the same station in May. In 1891 they were abundant in a bottom tow-net gathering collected at Station I. in July, and at Station IX. in June; and they were also abundant in a surface tow-net gathering at Station IX. in October. Cœlenterates were frequently obtained in 1892, but in none of the records for the selected stations are they described as abundant. In 1893 they were abundant in a bottom tow-net gathering at Station I. in August, and also at Station IV. in the same month, but at the latter station they were abundant in the surface as well as in the bottom tow-net; in the same year they were also abundant in a surface tow-net gathering at Station V. in May. In 1894 Cœlenterata were abundant in bottom tow-net gatherings collected in June at Stations III. and IV., while in August 1895 they were abundant in a surface gathering at Station III., and in a bottom gathering at Station IV.

From an examination of the annexed Table showing the general distribution of Ctenophora and Hydromedusæ, it will be observed that there is a somewhat curious contrast between their distribution and that of *Sagitta.* On comparing the total number of the records of Cœlenterata and *Sagitta* for each of the three inner and outer stations, it is found that while in the case of *Sagitta* the larger numbers are those of the outer stations, it is just the reverse with the Cœlenterates, the largest numbers being those of the inner stations. This contrast is better seen by arranging the numbers of the records of *Sagitta* and Ctenophora for each of the stations, in juxtaposition as a formula, thus :—

Formula (1) shows the total number of records of Cœlenterata for all the six stations, to which the numbers of the records of *Sagitta* are added for comparison :—

	Inner Stations.			Outer Stations.		
Numbers of the Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Number of Records for each Station (Cœlenterata)	62	66	53	44	34	37
Number of Records for each Station (*Sagitta*) -	66	58	56	74	77	74

It would thus appear that while *Sagitta* was comparatively scarce at the inner stations, Cœlenterata were more numerous. This difference does not seem be merely accidental; it is too general and persistent for that being the case, and is possibly due rather to a difference in the habits of the two kinds of organisms, but the reason, whatever it is, does not appear to be very obvious. An examination of the total numbers of the monthly records of Cœlenterata for each station, as well as for all the six stations, shows one or two other points of difference between the distribution of these organisms and that of *Sagitta*. In the case of these Cœlenterates the lowest numbers of records for any of the six stations are those for March and April, whereas, in the case of *Sagitta*, the lowest numbers are, with one exception, those for June and July. It will be further observed that, if the numbers of the monthly records are separated to correspond with the inner and the outer stations, ten of the monthly numbers for the inner stations are greater, and some of them considerably greater, than the corresponding numbers for the outer stations, while one of the other two numbers is equal to, and the second only slightly less than, the numbers for the same months for the outer stations, which emphasises still further the difference in the distribution of these Cœlenterates between the inner and outer stations. This is more clearly shown by the Formula (2).

Formula (2) shows the total number of records of Ctenophora and Hydromedusæ for each of the twelve months, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Names of the Months, - - - - - - -	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for (*a*) the Inner Stations, - -	18	18	3	4	10	16	19	24	8	21	20	20
(*b*) the Outer Stations, - -	8	10	2	1	9	16	15	12	10	14	8	10
(*c*) all the Six Stations, - -	26	28	5	5	19	32	34	36	18	35	28	30

That Cœlenterates were more numerous at the inner than at the outer stations is still further shown by separating the yearly total numbers so as to correspond with the two groups of stations as in Formula (3).

Formula (3) shows the total number of records of Ctenophora and Hydromedusæ for each of the seven years, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Numbers of the Years, - - - -	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for (*a*) the Inner Stations,	26	29	21	34	39	15	17
(*b*) the Outer Stations,	18	13	15	32	21	8	8
(*c*) all the Six Stations,	44	42	36	66	60	23	25

This formula shows that the number of yearly records for the outer stations is considerably lower for every year except 1892, when the respective numbers more nearly approximate. The highest number for the inner stations is that for 1893, and for the outer stations the highest number is that for 1892, while the lowest numbers for both are in 1894 and 1895.

(5.) Larval and Young Crustacea.

The next group of organisms described in the tow-net records which are of numerical importance are the young of various species of Crustacea belonging to the Decapoda, Schizopoda, and Cirripedia. Young and larval Crustacea are generally more or less frequent during the summer months, and sometimes they occur in great abundance, and because of this, and also because of their nutritive qualities, they form one of the most important constituents of fish-food existing in the sea; this remark applies, of course, to young Entomostracans as well as to the other orders of this great class of invertebrata. The minute nauplei, the larger megalops, and other stages of crustacean growth, along with embryo mollusca, form, no doubt, the principal food of young fishes of all kinds. Mr H. Dannevig, in his paper * describing his experiments in the rearing of larval and post-larval plaice and other flat fishes, gives some interesting observations bearing on the value of young Crustacea as fish food. The examination of the stomach of large numbers of young fishes at the Marine Laboratory of the Fishery Board for Scotland at Tarbert, Loch Fyne, during 1886-87, some of the results of which are published in the Board's Fifth Annual Report, also show that the importance of young Crustacea as fish food has long been recognised, and, as a matter of fact, their importance in this respect cannot well be overstated. It is evident, therefore, that the study of the distribution of these miniature forms, and of the influences that govern their increase or decrease, as well as the investigation of their life-histories and development, are well within the scope of scientific fishery work.

The records of miniature Crustacea included in the lists of tow-net fauna that form the basis of this paper refer chiefly to the young of various species of the Decapoda. Among the more common of the larval Decapoda included in the tow-net gatherings are those of *Portunus* (or swimming crabs), of *Porcellana longicornis*, of the Eupaguridæ (or soldier or hermit crabs), and of *Nephrops norvegicus* (the "Norway lobster"). The young of *Galathea* (or what some fishermen call the "bastard lobster") and of various shrimps, such as *Crangon* and *Pandalus*, which are at times more or less frequent, are also included among these records under the general name of young or larval Crustacea. Young Schizopoda, as such, are specially referred to in the lists only when they happen to be common or abundant; at other times they are included with the young Decapods. The larvæ and young of the Barnacle are more frequently recorded separately, but they also are sometimes included with the others, and the table of distribution comprises the records of all the three groups. The total number of records referring to young and larval Crustacea is about three hundred and forty, and an enumeration of them is contained in the annexed Table. This Table shows that in some respects the distribution of the immature Crustacea is somewhat similar to that of the Cœlenterata. If, for example, the total number of records of immature Crustacea for each of the three inner stations be compared with those for the three outer stations, they will be found on an average larger than the others, though this difference is not so marked as is the case with Cœlenterata.

It will also be observed that the yearly maxima of records for the various stations are not so regular, and also that the larger of the monthly records occur during the summer months.

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* Fifteenth Annual Report of Fishery Board for Scotland. Part iii. Pp. 175-193.

[TABLE.

TABLE XII., showing the Distribution of the Larval Crustacea (including Decapoda, Schizopoda, and Cirripedia), as indicated by the Tow-net Records for the Years, Months, and Stations :—

Three Inner Stations.	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	–	–	–	–	–	1	2	2	–	2	–	–	7
	1890, .	–	1	2	2	1	–	2	2	–	2	2	–	14
	1891, .	–	–	1	2	2	2	1	2	–	2	1	–	13
	1892, .	–	–	–	2	2	1	2	–	2	1	2	–	12
	1893, .	–	–	–	2	2	1	2	2	2	2	–	–	13
	1894, .	–	–	–	1	–	–	–	2	–	–	–	–	3
	1895, .	–	–	–	2	1	–	1	–	2	2	–	–	8
Total number of Records for all the Months,		–	1	3	11	8	5	10	10	6	11	5	–	70
III.	1889, .	–	–	–	–	–	1	2	2	–	–	1	–	6
	1890, .	–	–	–	2	–	–	2	2	–	2	1	–	9
	1891, .	–	–	–	–	3	–	1	2	1	2	2	–	11
	1892, .	–	–	–	2	1	1	2	–	2	1	–	–	9
	1893, .	–	–	–	–	2	2	2	2	2	1	1	–	12
	1894, .	–	–	–	2	–	1	–	–	–	–	–	1	4
	1895, .	–	–	–	2	1	–	–	2	1	2	–	1	9
Total number of Records for all the Months,		–	–	–	8	7	5	9	10	6	8	5	2	60
IV.	1889, .	–	–	–	–	–	1	2	2	–	–	1	–	6
	1890, .	–	–	–	1	1	–	2	2	–	2	1	–	9
	1891, .	–	–	–	2	1	1	2	2	–	–	1	–	9
	1892, .	–	–	1	2	2	–	2	–	2	2	1	–	12
	1893, .	–	–	–	2	1	1	–	1	2	1	–	–	8
	1894, .	–	–	–	2	–	1	–	1	–	–	–	–	4
	1895, .	–	–	–	1	2	–	–	2	–	2	–	–	7
Total number of Records for all the Months,		–	–	1	10	7	4	8	10	4	7	4	–	55

TABLE XII.—*continued.*

Three Outer Stations.	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	–	–	–	–	1	1	–	3	–	–	1	–	6
	1890, .	–	–	–	1	1	–	2	–	2	2	1		10
	1891, .	–	–	1	1	2	–	1	2	1	1	1	–	10
	1892, .	–	–	–	2	1	1	1	–	2	–	2	–	9
	1893, .	–	–	–	–	2	2	1	2	2	1	1	–	11
	1894, .	–	–	–	2	–	–	–	1	–	–	–	–	3
	1895, .	–	–	–	2	1	–	–	2	2	–	–	–	7
Total number of Records for all the Months,		–	–	1	8	8	4	5	10	9	4	6	1	56
VIII.	1889, .	–	–	–	–	–	1	1	2	–	–	1	–	5
	1890, .	–	–	–	1	2	–	–	2	2	2	–	1	10
	1891, .	–	–	–	2	1	2	2	2	2	1	1	–	13
	1892, .	–	–	–	–	2	–	–	–	2	–	–	–	4
	1893, .	–	–	–	–	1	–	2	1	1	–	–	1	6
	1894, .	–	–	–	2	–	–	–	1	–	–	–	–	3
	1895, .	–	–	–	1	1	–	–	2	2	2	–	–	8
Total number of Records for all the Months,		–	–	–	6	7	3	5	10	9	5	2	2	49
IX.	1889, .	–	–	–	–	–	1	2	2	–	–	1	–	6
	1890, .	–	–	–	1	1	–	–	2	1	2	–	1	8
	1891, .	–	–	–	1	1	1	2	1	2	–	–	–	8
	1892, .	–	–	1	–	3	–	1	–	2	1	1	–	9
	1893, .	–	–	–	1	2	2	2	1	–	1	–	–	9
	1894, .	–	–	–	1	–	1	–	1	–	–	–	–	3
	1895, .	–	–	–	2	1	–	–	2	2	–	–	–	7
Total number of Records for all the Months,		–	–	1	6	8	5	7	9	7	4	2	1	50

There is one aspect of the question of the distribution of these young Crustaceans, as well as of that of the various other invertebrates touched upon in this paper, that it is well to keep in view in an inquiry of this kind. I refer to the individual frequency or abundance of these organisms at one time, or at different times, apart from the frequency or rarity of their recorded occurrences. In the Table showing the distribution of the young Crustacea the maximum numbers of the yearly records are, speaking generally, those for 1891, 1892, and 1893; while, on the other hand, if the individual frequency of the creatures be taken into account, the results brought out will be somewhat different. For example, young Crustacea are described as abundant in four of the records for 1890

—viz., twice for Station I. in July, and once for Stations V. and VIII. in September. They are described as abundant in four of the records for 1891—viz., once for Station VIII. in May, once for Stations III. and IX. in July, and once for Station I. in August. They are recorded as abundant three times in 1892—once for each of the three Stations V., VIII., and IX. in September. Young Crustacea are described as abundant five times in 1893, once for Station I. and twice for Station III. in July, and also twice for Station V. in June. In 1894 there are over twenty records of young Crustacea, but in none are they described as abundant unless the three April records of young *Balani* (for Stations I., III., and IV.) be counted. On the contrary, in 1895 young Crustacea are described as abundant no fewer than twelve times, once at each of the three outer stations (V., VIII., and IX.) in April, once at Stations III. and V. in August, once at Stations I., III., and VIII. in September, and once at Stations I., III., and IV. in October—thus indicating that, notwithstanding the difference in the number of records when compared with those for 1891, 1892, or 1893, young Crustacea were locally more plentiful in the estuary and its vicinity in 1895 than during the other three years referred to.

The number of separate records of young Schizopoda is thirty-two for the seven years, and their distribution is indicated by the following three formulæ :—

Formula (1) shows the total number of records of Schizopoda for each of the stations :—

Number of the Stations, - - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, - -	12	4	0	3	7	6

Formula (2) shows the total number of records of Schizopoda for each of the twelve months :—

Names of the Months, - - - - - -	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, - -	0	0	2	6	4	3	2	4	4	5	1	1

Formula (3) shows the total number of records of Schizopoda for each of the seven years :—

Numbers of the Years, - - - -	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, -	5	16	6	1	4	0	0

The separate records of young *Balani* number fifty-eight. These larval Crustaceans are described as abundant in 1891 at Station I. in April, and in 1892 at Station III. in April. In 1893 they appear to have been plentiful at the inner stations, and are described as abundant in a surface tow-net gathering at Station I. in April, in the bottom tow-net at Station III. in June, and in a surface tow-net gathering at Station IV. in April. In 1894 young *Balani* are described as abundant in the bottom tow-net gatherings collected at Stations I., III., and IV. in April. In all the other records of these immature Crustaceans they are either described as common or few. Their distribution is indicated by the following three formulæ :—

Formula (1) shows the total number of records of young *Balani* for each of the six stations :—

Numbers of the Stations, - - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, - -	12	12	17	3	8	6

This formula shows that young *Balani* were, as might be expected, more numerous at the three inner stations, and that the highest number of records of these three stations is that for Station IV. This difference in the numbers of the records of these young forms is satisfactorily explained by the fact that the greater number of the Barnacle tribe, in our seas at least, are to be found attached to rocks, stones, and other objects inshore, and that there the young are usually to be found.

Formula (2) shows the total number of records of young *Balani* for each of the twelve months for all of the six stations:—

Names of the Months, - - - - - -	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, - -	0	0	1	27	14	10	4	2	0	0	0	0

It is evident from the numbers in this formula that the *Balani* hatch out principally in April, and that after April there is a rapid diminution in the production of larval forms, after which a more or less complete cessation takes place, there being not a single record for all the six months from September to February.

Formula (3) shows the total number of records of young *Balani* for each of the seven years for all the six stations:—

Numbers of the Years, - - - - -	1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, -	4	9	20	7	11	5	2

The number of records for 1891 is greatly in excess of that for any of the other seven years, but the reason for this marked difference does not seem to be very clear.

But the records of young Schizopoda and *Balani* form a comparatively small part of the whole number. The largest proportion of the three hundred and forty records of young and larval Crustacea are those of various species of Decapods, as has already been stated. But resuming consideration of the young Crustacea, we find by an examination of the general Table of Distribution that with one exception there are no records for January and February in all the seven years and for all the stations. After this a sudden increase is observed over all the stations, so much so that in regard to two of the stations the maximum of records is reached in April. From this time the number decreases somewhat till August, when a marked extension occurs over all the stations, the number afterward gradually diminishing till November. In December there is a somewhat sudden drop to one or two records, or, in the case of two of the stations, to none at all. This sudden increase and subsequent continuance of the moderately high numbers of the monthly records till November is an indication that in March and April an extensive and more or less simultaneous hatching of Crustacean ova takes place, and that it continues more or less all through the summer and autumn and on till about the end of the year. Of course it is not suggested that it is the same species that produces these young forms all the year through, but that the ova of different species hatch out at different seasons and thus keep up the supply of larval and young forms. The subjoined formulæ, prepared from the numbers in the Table of Distribution, show more clearly by the arrangement of the numbers in this way some of the special features referred to in the distribution of the young and larval Crustacea.

Formula (1) shows the total number of the records of young Crustacea for each of the six stations, which are divided into inner and outer stations:—

	Inner Stations.			Outer Stations.		
Number of the Stations, - - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station, -	70	60	55	56	49	50

This formula shows that Station I. has a higher number of records than any others, and that the total number of records for the three outer stations is 155, while the total number for the three inner stations is 185, or fully 16 per cent. more than the outer.

Formula (2) shows the total number of records of young Crustacea for each of the twelve months, for (*a*) the three inner stations, I., III., and IV.; (*b*) the three outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Names of the Months,		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations,	0	1	4	29	22	14	27	30	16	26	14	2
	(*b*) the Outer Stations,	0	0	2	20	23	12	17	29	25	13	10	4
	(*c*) all the Six Stations.	0	1	6	49	45	26	44	59	41	39	24	6

Formula (3) shows the total number of the records of young Crustacea for each of the seven years, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations:—

Numbers of the Years,		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations,	19	32	33	33	33	11	24
	(*b*) the Outer Stations,	17	28	31	22	26	9	22
	(*c*) all the Six Stations,	36	60	64	55	59	20	46

But besides young and larval Crustacea there are other immature forms mentioned in the lists of tow-net gatherings, and among them are occasional records of embryo and young Mollusca (including Gasteropoda, Lamellibranchiata, and Cephalopoda), young and larval Annelides, as well as plutei and other immature stages of star-fishes.

Infusoria and microscopic algæ are also described as being occasionally in greater or less abundance, but the records of these forms are few in number.

There are occasional records of larval and post-larval fishes among the lists of tow-net gatherings, but they also are comparatively few.

(6.) PELAGIC FISH OVA.

There are a considerable number of records of pelagic fish ova among the published lists of tow-net gatherings collected during the seven years. These records, which for the sake of clearness are arranged in tabular form similar to the other Tables, show that the total numbers for the inner and outer stations are in inverse ratio to the records of young Crustacea for the same stations, and this difference may probably be accounted for by the outer stations being nearer to the more important spawning grounds situated in the vicinity of the estuary.

[TABLE.

TABLE XIII., showing the Distribution of Fish Ova, as indicated by the Tow-net Records for the Years, Months, and Stations.

Three Inner Stations.	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
I.	1889, .	–	–	–	–	–	1	–	–	–	–	–	–	1
	1890, .	–	–	–	1	1	–	–	–	–	–	–	–	2
	1891, .	–	–	–	1	2	1	–	1	–	–	–	–	5
	1892, .	–	–	–	1	1	1	1	–	–	–	–	–	4
	1893, .	–	–	–	1	1	1	–	–	–	–	–	–	3
	1894, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1895, .	–	–	–	–	1	–	–	–	–	–	–	–	1
Total number of Records for all the Months,		–	–	–	5	6	4	1	1	–	–	–	–	17
III.	1889, .	–	–	–	–	–	–	–	–	–	–	–	–	–
	1890, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1891, .	–	–	–	–	1	1	1	1	–	–	–	–	4
	1892, .	–	–	–	1	–	1	–	–	–	–	–	–	2
	1893, .	–	–	–	–	1	–	–	–	–	–	–	–	1
	1894, .	–	–	–	2	–	–	–	–	–	–	–	–	2
	1895, .	–	–	–	–	1	–	–	–	–	–	–	–	1
Total number of Records for all the Months,		–	–	–	4	3	2	1	1	–	–	–	–	11
IV.	1889, .	–	–	–	–	–	1	–	–	–	–	–	–	1
	1890, .	–	–	–	1	2	–	–	–	–	1	–	–	4
	1891, .	–	–	–	–	2	1	1	1	–	–	–	–	5
	1892, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1893, .	–	–	–	–	1	–	–	–	–	–	–	–	1
	1894, .	–	–	–	1	–	–	–	–	–	–	–	–	1
	1895, .	–	–	–	–	1	–	–	–	–	–	–	–	1
Total number of Records for all the Months,		–	–	–	3	6	2	1	1	–	1	–	–	14

[TABLE.

TABLE XIII.—*continued.*

Three Outer Stations.	Years.	Number of the Records for each Month of each Year.												Totals for the Years and Stations.
		Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
V.	1889, .	–	–	–	–	1	–	–	–	–	–	–	–	1
	1890, .	–	–	1	1	1	–	–	–	–	–	–	–	3
	1891, .	–	–	1	1	1	1	1	1	–	–	–	–	6
	1892, .	–	–	1	–	2	1	1	–	–	–	–	–	5
	1893, .	–	–	–	–	1	–	–	1	–	–	–	–	2
	1894, .	–	1	–	1	–	–	–	–	–	–	–	–	2
	1895, .	–	–	–	1	1	–	–	1	–	–	–	–	3
Total number of Records for all the Months,		–	1	3	4	7	2	2	3	–	–	–	–	22
VIII.	1889, .	–	–	–	–	–	1	–	–	–	–	–	–	1
	1890, .	–	–	1	1	1	–	–	–	–	–	–	–	3
	1891, .	–	1	–	1	1	–	1	–	–	–	–	–	4
	1892, .	–	–	1	–	3	1	1	–	–	–	–	–	6
	1893, .	–	–	–	–	1	–	–	1	–	–	–	–	2
	1894, .	–	1	–	1	–	–	–	–	–	–	–	–	2
	1895, .	–	1	–	1	1	–	–	–	–	–	–	–	3
Total number of Records for all the Months,		–	3	2	4	7	2	2	1	–	–	–	–	21
IX.	1889, .	–	–	–	–	–	–	1	–	–	–	–	–	1
	1890, .	–	–	–	1	–	–	–	–	–	1	–	–	2
	1891, .	–	1	–	1	1	1	1	1	–	–	–	–	6
	1892, .	1	–	1	–	2	1	1	–	–	–	–	1	7
	1893, .	1	–	–	1	–	2	–	–	–	–	–	–	4
	1894, .	–	1	–	1	–	–	–	1	–	–	–	–	3
	1895, .	–	–	–	1	1	–	–	1	–	–	–	–	3
Total number of Records for all the Months,		2	2	1	5	4	4	3	3	–	1	–	1	26

It will be seen by a glance at the annexed Table that while the number of records of fish ova for Stations I., III., and IV. are 16, 11, and 14 respectively, those for the outer stations, V., VIII., and IX., are 22, 21, and 26. Moreover, it may be stated in connection with this difference between the inner and outer stations, and as tending to emphasise it, that the inner stations were examined a greater number of times than the outer stations, owing to the outer stations being more exposed, and therefore less easily examined during bad weather.

Formula (1) shows the number of records of pelagic fish ova for each of the six stations, thus :—

	(*a*) Inner Stations.			(*b*) Outer Stations.		
Numbers of the Stations, - - - -	I.	III.	IV.	V.	VIII.	IX.
Total number of Records for each Station,	16	11	14	22	21	26

This formula exhibits a marked difference between the number of records for the inner and outer stations, those for the outer stations being considerably larger. The total numbers for each of the two groups of stations are 41 and 69 respectively, showing a difference of 28 in favour of the outer stations, which is equal to nearly 41 per cent.—a difference which, as already stated, is doubtless owing to the outer stations being nearer the more important spawning-grounds.

Formula (2) shows the total number of records of pelagic fish ova for each of the twelve months, for (*a*) the inner stations, I., III., and IV.; (*b*) the outer stations, V., VIII., and IX.; and (*c*) for all the six stations :—

Names of the Months, - - - - - -		Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.
Total number of Records for each Month, for	(*a*) the Inner Stations, -	0	0	0	11	14	9	3	3	0	1	0	0
	(*b*) the Outer Stations, -	2	6	6	13	18	8	7	7	0	1	0	1
	(*c*) all the Six Stations, -	2	6	6	24	32	17	10	10	0	2	0	1

The monthly maxima of the records of pelagic fish ova, as might be expected, are to be found in the early spring and summer months, those for April and May especially being considerably higher than for the other months. The arrangement of the numbers to correspond with the inner and outer stations brings out another contrast between them : for the inner stations there are no records of fish ova till April, nor are there any after October, but for the outer stations there are two records in January, six in February and in March, and one in December ; while with the exception of June the numbers for the five central months are considerably above those of the corresponding months for the inner stations. This seems to indicate that spawning outside begins at a comparatively early period of the year, and may continue more or less over all the months : inside the estuary, on the other hand, spawning is later in commencing, and rarely continues beyond the month of August. It is probable that some of the ova collected at the inner stations may have drifted in or been carried in by currents from the outside, but it is also well known that there are a number of fishes, whose eggs float, that spawn within the estuary, so that the majority of the records for the inner stations are those of fishes that have really spawned there.

The next *Formula* (3) shows the total number of records of pelagic fish ova for each of the seven years for (*a*) the inner stations, (*b*) the outer stations, and (*c*) for all the six stations :—

		1889.	1890.	1891.	1892.	1893.	1894.	1895.
Total number of Records for each Year, for	(*a*) the Inner Stations, -	2	7	14	7	5	4	3
	(*b*) the Outer Stations, -	3	8	16	18	8	7	9
	(*c*) all the Six Stations, -	5	15	30	25	13	11	12

The largest number of records are those for 1891 and 1892. Another point in connection with the distribution of the pelagic fish ova, as shown by the published tow-net records, is the occurrence of them in several of the bottom tow-net gatherings. The records show that pelagic fish ova were found in bottom tow-net gatherings on eight different occasions, and it is noteworthy that on a few of these occasions no fish eggs were observed in the surface tow-net. This feature in the distribution of the pelagic fish ova cannot be shown in the Table, but is clearly indicated in the chart showing the comparative frequency of fish ova during the various months and years for all the stations. Pelagic fish ova were found in the bottom tow-net in 1889 at Station IV. in June; in 1890 at Station IV. in April and May, and at Station V. in May; in 1891 at Station I. in May, and in the same month at Station IV.; in 1892 at Station VIII. in May; and in 1894 at Station III. in April. In the records for all the seven years pelagic fish ova are three times described as abundant, and this only in 1894, when they are so described once for each of the three outer stations.

(7.) EXPLANATION OF THE CHARTS (Plates IV. to VII.).

Before concluding this paper on the tow-net gatherings collected in the Firth of Forth in connection with the trawling investigations of the Fishery steamer *Garland* during the years 1889 to 1895, and published in the Annual Reports for these years, I desire to say a few words about the charts appended hereto, by way of explaining their contents. These charts are intended to supplement what has already been said concerning the distribution of a few of the organisms that are numerically or otherwise of greater importance than the others in their relation to fishery questions. The charts exhibit certain important features respecting the distribution of these organisms that could not be readily shown in the Tables, by indicating concisely and graphically the relative scarcity or abundance of these organisms as well as their distribution vertically and horizontally. The years and months are arranged in regular sequence along the top of each chart. Where the organisms are present in the tow-net gatherings they are indicated under four degrees of frequency, viz.:—(1) as abundant, represented by the contraction "ab."; (2) as common, represented by "com."; (3) as frequent, represented by "fr."; and (4) as few or rare, represented by "f. or r."; if the organisms are altogether absent or are not referred to in the tow-net lists, this fact is indicated by the word "none," which is the last in the series. These abbreviations are used for each of the six stations, and are arranged alongside of them. The tow-net records for each month are represented by round dots; the dots are arranged to show whether the species referred to on the chart was abundant, common, frequent, few or rare, or absent in the gathering represented. Moreover, these dots are joined together by thick or thin lines: the thick lines show that the records are for bottom tow-net gatherings, and the thin lines for surface tow-net gatherings. When the distribution of two organisms or groups of organisms are represented separately on the same chart, they are distinguished from each other by using black and red lines. There is one other point in connection with the charts that requires to be explained. It has been stated that, for various reasons, the selected stations were not examined every month during the seven years, and that there are now and again omissions of the monthly records of tow-net fauna, either because no trawling was done, or if done that the usual lists of the contents of the tow-nets could not be prepared. The months when such omissions occurred are indicated on the charts by the thick and thin lines when crossing the column or columns under these months being discontinuous.

The first chart (Plate IV.) illustrates the distribution of *Calanus finmarchicus* and *Temora longicornis*. The first is shown by the black lines, the other by the red lines.

The second chart (Plate V.) illustrates the distribution of *Sagitta bipunctata* and the Cœlenterata. *Sagitta* is represented by the black lines, and the Cœlenterata by the red lines.

The third chart (Plate VI.) illustrates the distribution of the larval and young Decapod Crustacea (including the Schizopoda) and that of the larval and young *Balani*. The *Balani* are represented by the red lines, the others by the black lines.

The fourth chart (Plate VII.) shows the distribution of the pelagic fish ova so far as that is indicated by a study of the tow-net records for the seven years.

The following list contains the names of all the species of Mollusca and Crustacea referred to in the preceding notes, and of *Sagitta* and *Tomopteris*, and the stations where each was obtained :—

PLATE IV.

CHART showing the distribution and relative abundance of *Calanus finmarchicus* and *Temora longicornis* in the Firth of Forth.

Black Lines = *Calanus*; Red Lines = *Temora*. Thick Lines = Bottom tow net; Thin Lines = Surface tow net.

Relative frequency or absence
1889
1890
1891
1892
1893
1894
1895
Jan. Feb. Mar. April May June July Aug. Sept. Oct. Nov. Dec.
ab.
com.
fr.
f or r.
none
I
III
IV
V
VIII
IX

CHART showing the distribution and relative frequency of *Sagitta* and *Ctenophora*, (including the *Hydromedusæ*,) in the Firth of Forth, as indicated by the records of these organisms in the Lists of tow net gatherings referred to in the preceding notes.

Black Lines = *Sagitta*; Red Lines = *Ctenophora*. Thick Lines = Bottom tow net; Thin Lines = Surface tow net.

PLATE V.

Relative frequency or absence
1889
1890
1891
1892
1893
1894
1895
Jan. Feb. Mar. April May June July Aug. Sept. Oct. Nov. Dec.
ab.
com.
fr.
f. or r.
none
I
III
IV
V
VIII
IX

PLATE VI.

CHART showing the distribution and relative frequency of Larval and young Crustacea in the Firth of Forth, as indicated by the records of these organisms in the Lists of tow net gatherings referred to in the preceding notes.

Black Lines = Young Decapod Crustacea (chiefly); Red Lines = Young *Balani*. Thick Lines = Bottom tow net; Thin Lines = Surface tow net.

CHART showing the distribution and relative frequency of Pelagic Fish Ova in the Firth of Forth, as indicated by the records of them in the Lists of tow net gatherings referred to in the preceding notes.

Thick Lines = Bottom tow net Records. Thin Lines = Surface tow net Records.

PLATE VII.

(8. LIST OF THE SPECIES OF MOLLUSCA AND CRUSTACEA REFERRED TO IN THE PRECEDING NOTES, AND SHOWING THE STATIONS WHERE THEY WERE OBTAINED.

Names of the Species.	Stations.						Remarks.
	Station I.	Station III.	Station IV.	Station V.	Station VIII.	Station IX.	
MOLLUSCA.							
NUDIBRANCHIATA.							
Doris sp. (? *repanda*, A & H.), - -		×					1890, in November.
Doto coronata, Gm., - - - - -			×				1890, in December.
Eolis sp. (1), - - - - - -				×			1891, in April.
Eolis sp. (2), - - - - - -	×						1895, in May.
LAMELLIBRANCHIATA.							
Cuspidaria cuspidata (Olivi), - -						×	1893, in April.
PTEROPODA.							
Limacina retroversa (Flem.), - -	×	×		×		×	Not uncommon.
Clione borealis (Brug.), - - -		×			×		1889, Jan.; 1893, Dec.
CRUSTACEA.							
DECAPODA.							
Macropodia rostrata (Lin.), - -			×				1890 & '91, Oct. & Aug.
Crangon allmanni (Kin.), - - -	×	×	×	×	×	×	Frequent.
Egeon fasciatus, Risso, - - -		×					1891, in September.
Cheraphilus nanus (Kroyer), - -	×	×		×	×		Not very rare.
Hippolyte varians, Leach, - - -				×			1890, December.
Hippolyte fascigera, Gosse, - -					×		1894 & '95, Jan., Feb.
Spirontocaris pusiola (Kroyer), - -			×				1895, February.
Pandalus montagui, Leach, - -	×	×		×	×		Not rare in tow-nets.
Pandalus brevirostris, Rathke, - -		×		×			1881, March, Sept.
SCHIZOPODA.							
Boreophausia raschii (M. Sars), - -	×	×	×	×	×	×	Mod. com., 1889-90.
Thysanoessa neglecta (Kr.), - - -	×	×	×	×	×	×	Mod. com., 1891-92.
Siriella jaltensis, Czern., - - -				×			1893, March.
Siriella armata (M'Edw.), - - -		×					1892, March.
Gastrosaccus spinifer (Goes.), - -	×	×		×	×	×	Not uncommon.
Heteromysis formosa, S. L. Smith, -	×		×				1894-95, Aug., Feb.
Erythrops goesii, G. O. Sars, - -	×	×		×	×	×	Frequent.
Mysidopsis didelphys (Norm.), - -	×			×	×		1890-91, March.
Mysidopsis gibbosa, G. O. Sars, - -	×	×	×			×	Not uncommon.
Mysidopsis angusta, G. O. Sars, - -	×						1891, March.
Leptomysis gracilis, G. O. Sars, - -	×	×		×			1890-91, Oct.-Dec.
Leptomysis lingvura, G. O. Sars, -		×					1892, March.
Hemimysis lamornæ (Couch), - -	×	×		×	×	×	Not very rare.
Macropsis slabberi (Van Ben.), - -	×	×	×		×		Locally frequent.
Praunus flexuosus (Müller), - -		×	×				Locally frequent.
Praunus inermis (Rathke), - -				×	×	×	1895, February.
Schistomysis spiritus, Norm., - -	×	×	×	×		×	Not uncommon.
Schistomysis ornatus, G. O. Sars, -	×	×	×	×	×	×	Frequent.
Neomysis vulgaris (J. V. Thomp.), -			×				Locally frequent.
CUMACEA.							
Iphinoë trispinosa (Goodsir), - -	×						1889-90, July, Feb.
Cumopsis goodsiri (V. Ben.), - -		×					1891, September.
Leucon nasicus, Kroyer, - - -	×			×	×		Not very rare.
Eudorella truncatula (Spence Bate), -	×			×	×		Not very rare.
Diastylus rugosa, G. O. Sars, - -	×			×			Not very rare.
Pseudocuma cercaria (V. Ben.), - -	×	×		×	×	×	Frequent.
Campylaspis rubicunda (Lillj.), - -						×	1893, April; 1894, Aug.
Petalosarsia declivis (G. O. Sars), -						×	1893, April.

Names of the Species.	Stations.						Remarks.
	Station I.	Station III.	Station IV.	Station V.	Station VIII.	Station IX.	
ISOPODA.							
Gnathia (?) *maxillaris* (M'Edw.), -					×		1890, March.
Eurydice pulchra, Leach, - - -		×					1890, November.
Idothea baltica (Pallas), - - -	×	×	×	×	×	×	Frequent.
Idothea emarginata (Fabr.), - -	×						1891, May.
Idothea linaris (Lin.) - - -			×				1893, January.
Janira maculosa, Leach, - - -						×	1890, April.
AMPHIPODA.							
Hyperia galba (Mont.), - - -	×	×	×	×	×	×	Frequent.
Hyperoche tauriformis (Bate), - -	×	×	×	×	×	×	Frequent.
Parathemisto oblivia (Kr.), - -	×	×	×	×	×	×	Sometimes common.
Euthemisto compressa (Goes), - -				×			1892, Feb., Nov.
Callisoma crenata (Bate), - - -	×			×	×	×	1890, Oct.; 1893, Nov.; 1895, Dec.
Hippomedon denticulatus (Bate), -						×	1894, February.
Bathyporcia sp., - - - - -			×				1894, February.
Ampelisca sp., - - - - - -		×					1891, October.
Stenothoë marina (Bate), - - -				×		×	1890, April.
Argissa hamatipes (Norm.), - -	×			×	×	×	Not uncom. at Outer St'ns.
Metopa alderi, Bate, - - - -	×	×		×	×	×	Not rare in bot. gatherings.
Periocalodes longimanus (Bate), - -				×	×	×	Frequent.
Iphimedia obesa (Rathke), - - -				×			1892, January.
Apherusa bispinosa (Bate), - -	×	×	×	×	×	×	Frequent.
Apherusa borealis (Boeck), - -	×	×					Not very rare.
Paratylus swammerdami (M'Edw.), -	×	×	×	×			Frequent.
Dexamine sp., - - - - - -		×					Rare.
Melphidipella macera (Norm.), - -					×		1892, March.
Amathilla homari (Fabr.), - - -			×				1892, December.
Gammarus sp., - - - - - -			×				Rare.
Gammaropsis erythrophthalmus, Lillj.,				×			1890, December.
Dulichia sp., - - - - - -						×	Rare.
Pariambus typicus (Kr.), - - -		(?)	(?)		×	×	Not uncommon.
CLADOCERA.							
Evadne nordmanni, - - - - -		×	×	×	×	×	Frequent.
Podon (?) *polyphemoides*, - - -		×	×		×	×	Not uncommon.
COPEPODA.							
Calanus finmarchicus (Gun.), - -	×	×	×	×	×	×	Common.
Pseudocalanus elongatus, Boeck, -	×	×	×	×	×	×	Frequent.
Temora longicornis (Müll.) - -	×	×	×	×	×	×	Common.
Centropages hamatus, Lillj., - -	×				×		1889, June; '95, May, Dec.
Centropages typicus, Kr., - - -				×	×	×	1889, Aug.; 1890, Oct.
Metridia hibernica (B. & R.), - -						×	1892, May.
Candace pectinata, Brady, - - -	×		×	×	×	×	Not very rare.
Acartia sp., - - - - - -	×	×	×	×	×	×	Common.
Anomalocera patersoni (Temp.), - -	×	×	×	×	×	×	Frequent.
Parapontella brevicornis (Lub.), - -	×						1893, June.
Oithona (?) *similis*, Claus, - - -	×		×				Occasionally frequent.
Thalestris longimana, Claus, - -		×					1891, June.
Thalestris serrulatus, Brady, - -	(?)					×	1891, June.
Alteutha depressa (?) (Baird), - -	×	×		×		(?)	Not very rare.
Dermatomyzon nigripes (B. & R.), -	×						1894, August.
Monstrilla sp., - - - - -	×	×	×	×			1890-92, Aug., Oct.; 1893, [Oct.
Caligus rapax (Müller), - . -	×	×	×	×	×	×	Frequent.
ANELLIDA and MEDUSA.							
Sagitta bipunctata, G. & G., - -	×	×	×	×	×	×	Common.
Tomopteris oniscifrucis, Esch., - -	×	×	×	×	×	×	Frequent.
Aurelia aurita, Lam., - -	×			×			Sometimes common.

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